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LAKE MERCED WATER RESOURCE PLANNING STUDY

San Francisco Water Department

Appendices

DOCUMENTS DEPT

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APPENDICES

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APPENDICES

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APPENDIX A

PUBLIC UTILITIES COMMISSION RESOLUTION NO. 10,435

PUBLIC UTILITIES COMMISSION

CITY AND COUNTY OF SAN FRANCISCO

RESOLUTION No. 10,435

WHEREAS, The City and County of San Francisco hereinafter called the City, owns a tract of land in the City and County of San Francisco, herein called the Lake Merced Tract, delineated and designated upon the map attached hereto and made a part hereof, which tract of land was acquired from the Spring Valley Water Company and which is used and useful for water supply purposes; and

WHEREAS, His Honor, Mayor Robinson, has expressed the opinion that the Lake Merced Tract can be used both for water supply and park and recreational purposes, and that such use can best be developed and administered by the Park and Recreation Commission; and

WHEREAS, The Public Utilities Commission desires to cooperate with the Mayor in the development of the property for the enjoyment and recreation of all of the people of San Francisco:

THEREFORE, BE IT RESOLVED, as follows:

The Public Utilities Commission hereby confers upon the Park and Recreation Commission, the right to occupy, use and improve, for park and recreational purposes, all of the area in the Lake Merced Tract as delineated and designated upon said Map, subject to the following conditions:

1. The Park and Recreation Commission agrees that the primary purpose of the Lake Merced Tract is to supply potable water to the water consumers in San Francisco and that they will do nothing or suffer or permit anything to be done that, in the opinion of the Public Utilities Commission is detrimental to the quality or use of the water in Lake Merced.

2. The water drawn from the lake for all purposes shall be not more than the average yield of the lake and in no instance shall the water level be drawn down below 27 feet on the gauge.

3. In view of the fact that the lake may be used as the domestic water supply for the City, no swimming shall be permitted, no gasoline driven motorboats shall be permitted to operate regularly on the lake, all sewage shall be removed from the lake area, and nothing shall be done that would tend to make the waters of the lake unfit for human consumption.

4. The Public Utilities Commission shall have the right to construct or reconstruct and maintain pumping stations and keeper's quarters and other buildings on the Lake Merced Tract wherever and to such extend as deemed necessary with the approval of the Mayor.

5. The Public Utilities Commission shall have the right to lay and maintain pipe lines, together with such appurtenant structures as necessary, across the Lake Merced Tract, and to do such other work as necessary; it being agreed that any turf removed or damaged will be replaced or restored and, so far as is possible, the grounds shall be left in the same condition as they were before the work was started.

6. Neither the whole nor any part of the Lake Merced Tract shall be sold or traded or assigned or leased except that the Park and Recreation Commission shall have the right to grant concessions or leases, in the manner and for the purposes permitted by law and for the use and patronage of the public, subject to the provisions of Paragraph 7 next ensuing.

7. The Public Utilities Commission reserves the right to sell or trade any portion of the Lake Merced Tract, provided such action is necessary or advisable in the opinion of both the Public Utilities Commission and the Park and Recreation Commission. In the event of disagreement between these two commissions the matter will be referred to the Mayor for final decision.

***

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission

at its meeting of January 30, 1950

APPENDIX B

LAKE MERCED TRANSPORT PROJECT DATA SUMMARY

1992 LAKE MERCED TRANSPORT PROJECT DATA SUMMARY												STATUS P=PENDING C=COMPLETE
DATE SAMPLED	SAMPLE LOCATION	TDS mg/L	CHLORIDE mg/L	COLIFORM MPN	COND. μmhos	pH pH Unit	ALK mg/L	TURB NTU	HARDNESS mg/L	IRON mg/L	MANGANESE mg/L	
MAY. 27	JMD-1	456	96	>240000	690	ND	286	3	326	PENDING	PENDING	P
•	T-37	434	102	NR	NR	NR	NR	NR	NR	NR	NR	C
•	ZOO#3	251	39	NR	NR	NR	NR	NR	NR	NR	NR	C
•	ZOO#4	439	48	NR	NR	NR	NR	NR	NR	NR	NR	C
MAY. 29	JMD-1	467	87	> 240000	650	ND	290	5	336	NR	NR	C
•	Oceanside Disch	453	104	NR	NR	NR	NR	NR	NR	NR	NR	C
JUN. 2	T-10	30302	13850	NR	NR	NR	NR	NR	NR	PENDING	PENDING	P
•	Oceanside	870	100	20	750	7.1	294	ND	275	PENDING	PENDING	P
•	ZOO#3	358	43	NR	NR	NR	NR	NR	NR	NR	NR	C
•	T-37	593	122	< 20	NR	NR	NR	NR	NR	NR	NR	C
•	ZOO#4	419	47	NR	NR	NR	NR	NR	NR	NR	NR	C
JUN. 9	Oceanside 1&2	497	110	2100	740	7.2	304	46	282	PENDING	PENDING	P
•	T-37	639	132	20	NR	NR	NR	NR	NR	NR	NR	C
JUN.10	T-71	415	83	24000	560	6.9	238	70	266	PENDING	PENDING	P
•	T-72	307	71	54000	510	6.9	212	50	222	PENDING	PENDING	P
•	T-43	668	186	NR	980	6.8	335	80	325	PENDING	PENDING	P
•	T-44	623	186	NR	1100	6.8	338	90	334	PENDING	PENDING	P
•	T-46	446	101	490	680	6.8	259	90	290	PENDING	PENDING	P
•	T-42	461	90	NR	NR	NR	NR	NR	NR	NR	NR	C
•	T-67	375	79	>240000	560	6.9	199	1.4	255	PENDING	PENDING	P
•	T-40	562	121	NR	NR	NR	NR	NR	NR	NR	NR	C
•	T-41	465	101	NR	NR	NR	NR	NR	NR	NR	NR	C
•	T-38	419	102	NR	NR	NR	NR	NR	NR	NR	NR	C
•	T-39	453	107	NR	NR	NR	NR	NR	NR	NR	NR	C
JUN. 12	T-42	537	83	< 20	840	6.6	259	66	343	PENDING	PENDING	P
•	LAKE/1 FT	481	107	50	700	8.3	264	8.5	264	PENDING	PENDING	P
•	T-71	398	82	5420	610	6.9	227	7	258	PENDING	PENDING	P
•	T-72	291	71	3500	560	6.9	211	2	229	PENDING	PENDING	P
•	T-63	324	63	330	530	8.3	88	2.5	220	PENDING	PENDING	P
•	T-67	351	74	> 240000	580	6.8	79	16	245	PENDING	PENDING	P
•	T-41	403	102	< 20	710	6.6	253	58	286	PENDING	PENDING	P
•	JMD-2	310	70	790	540	6.6	164	7	226	PENDING	PENDING	P
JUN. 16	T-47	NR	NR	< 20	NR	NR	NR	NR	NR	NR	NR	C
•	T-49	NR	NR	60	NR	NR	NR	NR	NR	NR	NR	C
•	T-53	NR	NR	130	NR	NR	NR	NR	NR	NR	NR	C
•	T-55	NR	NR	330	NR	NR	NR	NR	NR	NR	NR	C
•	T-62	NR	NR	490	NR	NR	NR	NR	NR	NR	NR	P
•	T-60	NR	NR	3500	NR	NR	NR	NR	NR	NR	NR	C
•	T-64	NR	NR	1300	NR	NR	NR	NR	NR	NR	NR	C
•	T-65	NR	NR	330	NR	NR	NR	NR	NR	NR	NR	C
JUN. 16	T-10	1	6	< 20	8	7.3	4	0	16	PENDING	PENDING	P
•	T-11	494	127	230	840	7.0	316	50	270	PENDING	PENDING	C
•	T-37	676	181	20	1080	7.0	407	52	319	PENDING	PENDING	P
•	T-38	424	103	490	700	6.9	250	61	249	PENDING	PENDING	P
•	T-39	495	108	330	760	6.9	302	60	249	PENDING	PENDING	P
•	T-40	494	116	< 20	800	6.9	324	65	268	PENDING	PENDING	P
•	Oceanside Disch	514	129	310	820	7.0	316	53	270	PENDING	PENDING	P
•	Lake Grab	457	109	70	740	8.5	259	8	267	PENDING	PENDING	P

NOTE: NS = NO SAMPLE; ND = NOT DETERMINED; NR = NOT REQUIRED

1992 LAKE MERCED TRANSPORT PROJECT(R9217) SUMMARY JULY 3 - JULY 22, 1992

DATE SAMPLED	SAMPLE NUMBER	SAMPLE LOCATION	TOTAL CFU	FECAL CFU	TDS mg/L	CHLORIDE mg/L	ALK mg/L	HARDNESS mg/L	TURB NTU	COND. µmhos	pH pH Unit	IRON mg/L	MANGANESE mg/L
JUL 3	1	Oceanside	< 4	< 2	-	-	-	-	-	-	-	-	-
•	2	Oceanside	-	-	509	120	292	266	26	660	6.9	PENDING	PENDING
•	3	T-43/44	< 4	< 2	-	-	-	-	-	-	-	-	-
•	4	T-43/44	-	-	629	197	316	353	120	880	6.6	PENDING	PENDING
•	5	T-41	< 4	< 2	-	-	-	-	-	-	-	-	-
•	6	T-41	-	-	496	115	274	292	60	620	6.6	PENDING	PENDING
•	7	T-42	46	< 2	-	-	-	-	-	-	-	-	-
•	8	T-42	-	-	710	132	232	430	89	760	6.6	PENDING	PENDING
•	9	T-46	< 4	< 2	-	-	-	-	-	-	-	-	-
•	10	T-46	-	-	442	107	262	313	88	620	7.0	PENDING	PENDING
JUL 7	1	T-41	< 4	< 2	-	-	-	-	-	-	-	-	-
•	2	T-41	-	-		115	264	288	77	580	6.7	PENDING	PENDING
•	3	T-42	56	< 2	-	-	-	-	-	-	-	-	-
•	9	T-42	-	-		131	232	387	86	700	6.6	PENDING	PENDING
•	9	T-49/52	28	< 2	-	-	-	-	-	-	-	-	-
•	6	T-49/52	-	-		127	273	330	2	610	7.3	PENDING	PENDING
•	4	T-58/59	< 4	< 2	-	-	-	-	-	-	-	-	-
•	9	T-58/59	-	-		85	240	260	2	500	7.1	PENDING	PENDING
•	9	T-61	< 4	< 2	-	-	-	-	-	-	-	-	-
•	10	T-61	-	-		164	278	394	2	640	7.0	PENDING	PENDING
•	11	T-63	5100	6	-	-	-	-	21	-	-	-	-
•	12	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
•	13	T-67	100	< 2	-	-	-	-	-	-	-	-	-
•	14	T-67	-	-	-	-	-	-	1	-	-	-	-
•	15	T-71	100	< 2	-	-	-	-	-	-	-	-	-
•	16	T-71	-	-	-	-	-	-	2	-	-	-	-
•	17	T-73	600	4	-	-	-	-	-	-	-	-	-
•	18	T-73	-	-	-	-	-	-	25	-	-	-	-
•	19	Oceanside	20	< 2	-	-	-	-	-	-	-	-	-
•	20	Oceanside	-	-	570	129	290	260	49	620	7.1	PENDING	PENDING
JUL 9	1	ZOO #3	-	-	-	46	-	-	-	380	7.5	-	-
DATE SAMPLED	SAMPLE NUMBER	SAMPLE LOCATION	TOTAL CFU	FECAL CFU	TDS mg/L	CHLORIDE mg/L	ALK mg/L	HARDNESS mg/L	TURB NTU	COND. µmhos	pH pH Unit	IRON mg/L	MANGANESE mg/L
JUL 15	1/2	T-41	< 4	< 2	520	116	274	290	75	860	6.7	PENDING	PENDING
NOTE:	3/4	T-42	< 4	< 2	626	131	238	353	61	960	6.6	PENDING	PENDING
SAMPLES	5/6	Oceanside	200	< 2	506	124	276	255	40	850	6.9	PENDING	PENDING
2,4,6	7/8	T-60	< 4	< 2	547	128	236	312	1	810	7.0	PENDING	PENDING
8, 10	9/10	JMD-2	< 100	< 2	578	134	252	348	1	780	7.4	PENDING	PENDING
Coliform	11	ZOO #3	NR	NR	364	45	NR	NR	NR	500	7.7	NR	NR
JUL 21	1	T-40	< 4	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR
	2	T-41	< 4	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR
	3	T-49/52	800	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR
	4	T-58/59	< 4	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR
	6	T-60	< 4	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR
	6	T-61	4	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR
	7	T-63	4	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR
	8	T-67	1200	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR
	9	T-71	< 4	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR
	10	T-72	< 4	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR
	11	T-73	< 4	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR
	12	E - 1	< 4	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR
	13	S - 1	< 4	2	NR	NR	NR	NR	NR	NR	NR	NR	NR
	14	W - 1	< 4	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR
JUL 22	1 & 2/A	JMD-2	< 4	2	421	54	177	218	1	540	6.3	PENDING	PENDING
NOTE:	3 & 4/B	OCEANSIDE	< 4	< 2	523	132	284	264	40	900	6.2	PENDING	PENDING
2,4,6	5 & 6/C	LAKE	< 4	800	618	111	264	282	8	760	8.0	PENDING	PENDING
8,10 &	7 & 8/D	T-41	< 4	6	674	116	278	297	57	880	6.1	PENDING	PENDING
12	9 & 10/E	T-42	< 4	< 2	663	136	236	346	86	940	5.9	PENDING	PENDING
Coliform	11 & 12/F	T-60	< 4	< 2	662	125	238	317	1	820	6.4	PENDING	PENDING
ONLY	1[illegible]	ZOO #3	NR	NR	397	78	NR	NR	NR	530	7.0	NR	NR

NOTE: NS – NO SAMPLE; ND – NOT DETERMINED; NR – NOT REQUIRED

1992 LAKE MERCED TRANSPORT PROJECT(R9217) SUMMARY

DATE SAMPLED	SAMPLE NUMBER	SAMPLE LOCATION	TOTAL CFU	FECAL CFU	TDS mg/L	CHLORIDE mg/L	ALK mg/L	HARDNESS mg/L	TURB NTU	COND. µmhos	pH pH Unit	IRON mg/L	MANGANESE mg/L
JUL. 30	1	T-41	56	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR
	2	T-42	< 4	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR
	3	T-49/52	< 4	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR
	4	T-58/59	16	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR
	5	T-60	< 4	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR
	6	T-61	4	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR
	7	T-63	< 4	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR
	8	T-71	< 4	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR
	9	T-72	4	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR
	10	T-73	28	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR
	11	E-1	110	6	NR	NR	NR	NR	NR	NR	NR	NR	NR
	12	S-1	12	2	NR	NR	NR	NR	NR	NR	NR	NR	NR
	13	W-1	4	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR
JUL. 31	1	JMD-2	28	< 2	NR	NR	NR	NR	NR	NR	NR	NR	NR

NOTE: NS = NO SAMPLE; ND = NOT DETERMINED; NR = NOT REQUIRED

LAKE MERCED TRANSPORT 1220W 06/26/92

DEWATERING WELLS DISCHARGE DATA

	Well no.	Discharge Loc.	Date Turned On	GPM Rate	Gallons per Day	
Great Highway	Chevron	SWOO	15-Mar-92	60	86,400	Present Daily Discharge to SWOO: 6,436,800 gal
	AP-1	SWOO	28-Feb-92	90	129,600	
	AP-2	SWOO	28-Feb-92	90	129,600	
	AP-3	SWOO	28-Feb-92	90	129,600	
	AP-4	SWOO	28-Feb-92	90	129,600	
	T1-A	SWOO	28-Mar-92	90	129,600	
	T1-B	SWOO	28-Mar-92	90	129,600	
	T-1	SWOO	30-Mar-92	90	129,600	
	T-2	SWOO	30-Mar-92	90	129,600	
	T-3	SWOO	30-Mar-92	90	129,600	
	T-4	SWOO	30-Mar-92	90	129,600	
	T-5	SWOO	28-Mar-92	90	129,600	
	T-6	SWOO	28-Mar-92	90	129,600	
	T-7	SWOO	28-Mar-92	90	129,600	
	T-8	SWOO	28-Mar-92	90	129,600	
	T-9	SWOO	28-Mar-92	90	129,600	
	T-10	SWOO	28-Mar-92	90	129,600	
	T-11	SWOO	15-Apr-92	90	129,600	
	T-12	SWOO	15-Apr-92	90	129,600	
	T-13	SWOO	15-Apr-92	90	129,600	
	T-14	SWOO	15-Apr-92	90	129,600	
	T-15	SWOO	15-Apr-92	90	129,600	
Oceanside	T-16	SWOO	06-May-92	120	172,800	
	T-17	SWOO	06-May-92	120	172,800	
	T-18	SWOO	06-May-92	120	172,800	
	T-19	SWOO	06-May-92	120	172,800	
	T-20	SWOO	06-May-92	120	172,800	
	T-21	SWOO	06-May-92	120	172,800	
	T-22	SWOO	07-May-92	120	172,800	
	T-23	SWOO	07-May-92	120	172,800	
	T-24	SWOO	07-May-92	120	172,800	
	T-25	SWOO	07-May-92	120	172,800	
	T-26	SWOO	26-May-92	120	172,800	
	T-27	SWOO	26-May-92	120	172,800	
	T-28	SWOO	26-May-92	120	172,800	
	T-29	SWOO	22-May-92	120	172,800	
	T-30	SWOO	22-May-92	120	172,800	
	T-31	SWOO	22-May-92	120	172,800	
	T-32	SWOO	22-May-92	120	172,800	
	T-33	SWOO	22-May-92	120	172,800	
	T-34	SWOO	22-May-92	120	172,800	
	T-35	SWOO	22-May-92	120	172,800	
	T-36	SWOO	22-May-92	120	172,800	

LAKE MERCED TRANSPORT 1220W 06/26/92

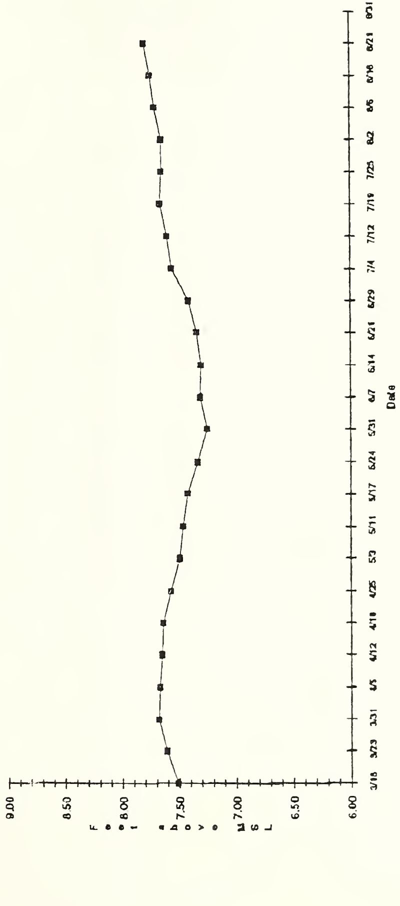
DEWATERING WELLS DISCHARGE DATA

	Well no.	Discharge Loc.		Date Turned On	GPM Rate	Gallons per Day	
Great Highway & Skyline Blvd.	T-37	Oceanside		26-May-92	120	172,800	Present Daily Discharge to Lake Merced: 3,974,400 gal
	T-38	Oceanside		26-May-92	120	172,800	
	T-39	Oceanside		26-May-92	120	172,800	
	T-40	Oceanside		26-May-92	120	172,800	
	T-41	C.B.1	LM	26-May-92	120	172,800	
	T-42	C.B.1	LM	26-May-92	120	172,800	
	T-43	C.B.2	LM	26-May-92	120	172,800	
	T-44	C.B.2	LM	26-May-92	120	172,800	
	T-45	C.B.3	LM	26-May-92	120	172,800	
	T-46	C.B.3	LM	26-May-92	120	172,800	
	T-47	C.B.4N	LM	12-Jun-92	120	172,800	
	T-48	C.B.4N	LM	12-Jun-92	120	172,800	
	T-49	C.B.4S	LM	12-Jun-92	120	172,800	
	T-50	C.B.4S	LM	12-Jun-92	120	172,800	
	T-51	C.B.4S	LM	12-Jun-92	120	172,800	
	T-52	C.B.4S	LM	12-Jun-92	120	172,800	
	T-53	C.B.5	LM	12-Jun-92	120	172,800	
	T-54	C.B.5	LM	12-Jun-92	120	172,800	
	T-55	C.B.6	LM	12-Jun-92	120	172,800	
	T-56	C.B.6	LM	12-Jun-92	120	172,800	
	T-57	C.B.6	LM	12-Jun-92	120	172,800	
	T-58	C.B.7	LM	24-Jun-92	120	172,800	
	T-59	C.B.7	LM	24-Jun-92	120	172,800	
John Muir Drive	T-60	M.H.	LM	24-Jun-92	100	144,000	Anticipated Daily Discharge to Lake Merced: 1,584,000 gal
	T-61	M.H.	LM	24-Jun-92	100	144,000	
	T-62	JMD-2			100	144,000	
	T-63	JMD-2			100	144,000	
	T-64	JMD-2			100	144,000	
	T-65	JMD-2			100	144,000	
	T-66	JMD-2			100	144,000	
	T-67	JMD-2			100	144,000	
	T-68	JMD-2			100	144,000	
	T-69	JMD-2			100	144,000	
	T-70	JMD-2			100	144,000	
OFS Site	T-71	JMD-1			100	144,000	Anticipated Daily Discharge to Pump Station: 720,000 gal
	T-72	LMPS			80	115,200	
	T-73	LMPS		28-May-92	80	115,200	
	OFS-1	LMPS			80	115,200	
	OFS-2	LMPS		26-May-92	80	115,200	
	OFS-3	LMPS		28-May-92	80	115,200	
	OFS-4	LMPS		26-May-92	80	115,200	

Total Anticipated Daily Discharge: 12,830,400 gal

Total Discharge for Project thru 6/22/92: 464 600.000 gal

LAKE MERCED TRANSPORT
Lake Merced Pump House Water Level
(Feet above MSL)
March 10, 1992 - August 31, 1992

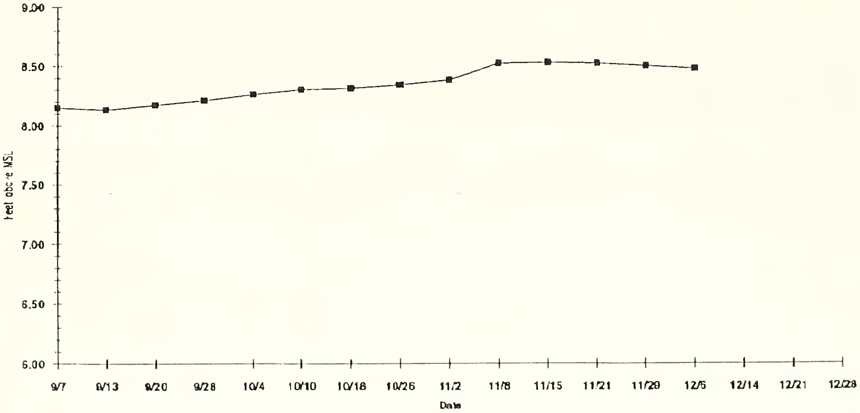


LAKE MERCED TRANSPORT

Weekly Average Water Levels
Lake Merced Pump House Water Level
(Feet above MSL)
March 10, 1992 - August 31, 1992

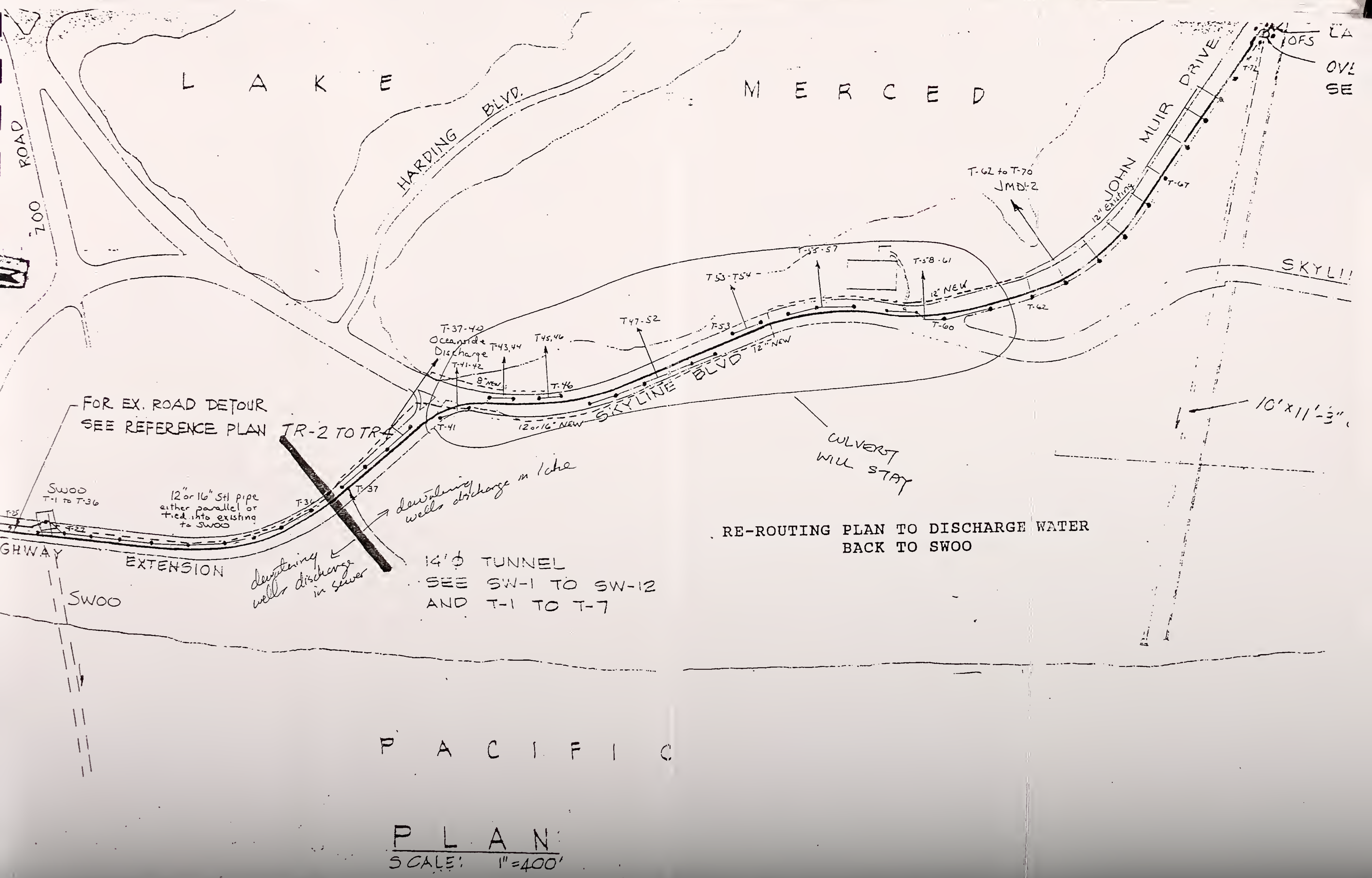
Week of	Level
3/16	7.51
3/23	7.61
3/31	7.68
4/5	7.67
4/12	7.66
4/18	7.64
4/25	7.57
5/3	7.49
5/11	7.46
5/17	7.42
5/24	7.33
5/31	7.25
6/7	7.31
6/14	7.30
6/21	7.34
6/29	7.41
7/4	7.56
7/12	7.60
7/19	7.66
7/26	7.65
8/2	7.65
8/6	7.71
8/16	7.76
8/21	7.80
8/31	

LAKE MERCED TRANSPORT
Lake Merced Pump House Water Level
(Feet above MSL)
September 1, 1992 - December 31, 1992



LAKE MERCED TRANSPORT
Weekly Average Water Levels
Lake Merced Pump House Water Level
(Feet above MSL)
September 1, 1992 - December 31, 1992

Week of	Level
9/7	8.15
9/13	8.13
9/20	8.17
9/28	8.21
10/4	8.26
10/10	8.30
10/18	8.31
10/26	8.34
11/2	8.38
11/8	8.52
11/15	8.53
11/21	8.52
11/29	8.50
12/6	8.48
12/14	
12/21	
12/28	



RE-ROUTING PLAN TO DISCHARGE WATER
BACK TO SWOO

APPENDIX C

WATER QUALITY TESTING AT LAKE MERCED AND DRINKING WATER STANDARDS

SFWD ANNUAL WATER QUALITY TESTING

SAN FRANCISCO WATER DEPARTMENT

WATER QUALITY DIVISION

MINERAL ANALYSIS FOR LAKE MERCED RESERVOIR, NORTH

Date Sampled	9/5/89	9/12/90	9/24/91
Chemical Constituents			
Cations (+) (mg/L)			
Aluminum	0.036	0.01	0.093
Arsenic	0.005	0.002	0.005
Barium	0.05	0.03	0.08
Boron	0.2	0.2	0.7
Cadmium	<0.001	<0.001	<0.001
Calcium	34.8	34	45
Chromium	<0.001	0.003	<0.005
Copper	<0.001	0.002	<0.005
Iron	0.085	0.02	0.16
Lead	0.003	<0.001	<0.001
Magnesium	36	38	44
Manganese	0.090	0.060	0.114
Mercury	<0.001	<0.001	<0.002
Potassium	2.3	2.6	2.4
Selenium	<0.005	<0.001	<0.005
Silver	<0.001	0.001	<0.001
Sodium	67.7	79	82
Zinc	<0.001	0.001	<0.001
Anions (-) (mg/L)			
Bicarbonate	225	--	--
Carbonate	6.5	--	--
Chloride	93.2	108	100
Flouride	0.28	0.3	0.1
Nitrate	0.3	0.3	<0.4
Nitrite	0.001	<0.01	<0.3
Phosphate	0.006	<0.01	0.056
Sulfate	28.2	24	48
Nonionics (mg/L)			
Dissolved Oxygen	7.2	--	5.8
Dissolved Silica (SiO_2)	28.3	32	42
Derived Values (mg/L)			
Hardness as $CaCO_3$	235	231	292
Alkalinity as $CaCO_3$	220	243	278
Other Characteristics			
Total Dissolved Solids (ppm)	432	472	511
Conductivity (uS/cm)	720	787	851
pH	8.7	8.7	8.2
Turbidity (NTU)	12	12	7.7
Color (units)	25	50	20

BORING B-1 AT LAKE MERCED SEWAGE PUMP STATION

RECEIVED
FEB 05 1992
P.M. DIVISION

February 3, 1992

James Chia
Project Manager
Bureau of Engineering
1680 Mission Street, 4th Floor
San Francisco, California 94103

Re Primary and Secondary Drinking Water Parameter Testing for Boring B-1, Lake Merced Transport Project

Dear James:

Please find enclosed the full results for primary and secondary drinking water analysis for the groundwater sampled from boring B-1 located on John Muir Drive in front of the Lake Merced Sewage Pump Station. Results labeled B-1 are for the true sample, and results labeled B-5 are for a reagent-grade water blank.

B1 and B5
appear to b
switched -
see Feb 11
EV

Environmental Science Associates, Inc.
301 Brannan Street
Suite 200
San Francisco, California
94107-1811
(415) 896-5900
FAX 896-0332

Los Angeles

Sacramento

With respect to general mineral analyses (including radioactivity analyses), organic chemical analyses, bacteriological analyses, and free chlorine residue analyses, the sample B-1 meets all the mandatory health-related standards as indicated in the table sent by Andrew DeGraca to Mike Kobler on December 23, 1991. The analytic results given here are generally better than those reported in my letter of January 22, 1992, reporting preliminary water quality results.

On the basis of these results, it can be assumed that dewatering flows in the vicinity of John Muir Drive will be suitable for discharge to Lake Merced.

If you have any questions regarding these results, please give me a call.

Sincerely,

Denise Rousseau

Denise Rousseau
Environmental Compliance Monitor

cc: D. Munakata, CWP
D. Learner, Rec/Park
D. DeGraca, Water Dept.
M. Kobler, Stone & Webster

TO: MIKE KOBLER

PLEASE CONTACT ANDREW DE GRACA PROVIDE HE WITH THESE INFORMATION AND OBTAIN SFWD'S APPROVAL TO DISCHARGE DEWATERING WATER IN THE LAKE IN WRITING.

THANKS!
J. CHIA
2-5-92

CC: FRANK FILCE
KAREN KUBICK
FILE

SEQUOIA ANALYTICAL
680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Date of Report: Jan 29, 1992
Lab Name: Sequoia Analytical
Sampler Name: Michele Bellows
Employed by: Orion Environmental
Sample ID No.: 201-1546
Date/Time Sample Collected: 1/13/92
Date/Time Sample Received @ Lab: 1/13/92, 5:18 pm
Date Analyses Completed: Jan 29, 1992

GENERAL MINERAL, PHYSICAL, INORGANIC, & RADIOLOGICAL CHEMICAL ANALYSES

System Name: Orion Environmental
System Number:
Name/No. of Sample Source: B-1

User ID: |__|__|__|
Station Number: |__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|

Date/Time of Sample: |9|2|0|1|1|3|-|-|-|-| (Y Y M M D D T T T T)
Laboratory Code: |5|1|1|3|

Date Analyses Completed: |9|2|0|1|2|9| (Y Y M M D D)

Submitted by:
Phone #:

MCL/Reporting Units	Constituent	Entry #	Analyses Results
mg/L	Total Hardness (as CaC03)	00900	250
mg/L	Calcium (Ca)	00916	32
mg/L	Magnesium (Mg)	00927	41
mg/L	Sodium (Na)	00929	< 0.5
mg/L	Potassium (K)	00937	< 1.0
Total Cations	meq/L Value: --		
mg/L	Total Alkalinity (as CaC03)	00410	2.0
mg/L	Hydroxide (OH)	71830	< 0.10
mg/L	Carbonate (CO3)	00445	< 2.0
mg/L	Bicarbonate (HC03)	00440	2.0
* mg/L +	Sulfate (S04)	00945	0.16
* mg/L +	Chloride (Cl)	00940	0.36
45 mg/L	Nitrate (NO3)	71850	13
1.4-2.4 mg/L	Fluoride (F) Temp. Depend.	00951	< 0.10
Total Anions	meq/L Value: --		
Std Units	pH (Laboratory)	00403	7.2
** μmho/cm +	Specific Conductance (E.C.)	00095	9.0
*** mg/L +	Total Filterable Residue at 180 C (TDS)	70300	32
UNITS	Apparent Color (Unfiltered)	00081	< 3.0
TON	Odor Threshold at 60 C	00086	< 1.0
NTU	Lab Turbidity	82079	0.16
0.5 mg/L +	MBAS	38260	< 0.020

* 250-500-600 ** 900-1600-2200 *** 500-1000-1500

INORGANIC CHEMICALS

MCL/Reporting	Constituent	* DLR	Entry	Analyses
1000 µg/L	Aluminum (Al)	100	01105	< 100
50 µg/L	Arsenic (As)	10	01002	< 10
1000 µg/L	Barium (Ba)	100	01007	< 100
10 µg/L	Cadmium (Cd)	1	01027	< 1.0
50 µg/L	Chromium (Total Cr)	10	01034	< 10
1000 µg/L +	Copper (Cu)	50	01042	< 50
300 µg/L +	Iron (Fe)	100	01045	< 100
50 µg/L	Lead (Pb)	5	01051	< 5.0
50 µg/L +	Manganese (Mn)	30	01055	40
2 µg/L	Mercury (Hg)	1	71900	< 1
10 µg/L	Selenium (Se)	5	01147	10
50 µg/L	Silver (Ag)	10	01077	< 10
5000 µg/L	Zinc (Zn)	50	01092	< 50

RADIOACTIVITY ANALYSES

15 pCi/l	Total Alpha	01501	1.5
pCi/l	Total Alpha Counting Error	01502	± 1.4
50 pCi/l	Total Beta	03501	0.0
pCi/l	Total Beta Counting Error	03502	± 3.3
20 pCi/l	Natural Uranium	28012	- -
pCi/l	Total Radium 226	09501	- -
pCi/l	Total Radium 226 Counting Error	09502	- -
pCi/l	Total Radium 228	11501	- -
pCi/l	Total Radium 228 Counting Error	11502	- -
5 pCi/l	Ra 226 + Ra 228	11503	- -
pCi/l	Ra 226 + Ra 228 Counting Error	11504	- -
pCi/l	Radon 222	82303	- -
pCi/l	Radon 222 Counting Error	82302	- -
20,000 pCi/l	Total Tritium	07000	- -
pCi/l	Total Tritium Counting Error	07001	- -
8 pCi/l	Total Strontium-90	13501	- -
pCi/l	Total Strontium-90 Counting Error	13502	- -

ADDITIONAL ANALYSES

NTU	Field Turbidity	82078	- -
C	SourceTemperature	00010	- -
	Langlier Index Source Temp.	71814	- -
	Langlier Index at 60 C	71813	- -
Std. Units	Field pH	00400	- -
	Aggressiveness Index	82383	- -
mg/L	Silica	00955	- -
mg/L	Phosphate	00650	- -
mg/L	Iodide	71865	- -
	Sodium Absorption Ratio	00931	- -
	Asbestos	81855	N.D.
	Boron	01020	- -

SEQUOIA ANALYTICAL

Nokowhat D. Herrera
Project Manager

+ indicates Secondary Drinking Water Standards

* Detection Limit for Reporting Purposes

SEQUOIA ANALYTICAL
680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Date of Report: Jan 29, 1992
Lab Name: Sequoia Analytical
Sampler Name: Michele Bellows
Employed by: Orion Environmental
Sample ID No.: 201-1547
Date/Time Sample Collected: 1/13/92
Date/Time Sample Received @ Lab: 1/13/92, 5:18 pm
Date Analyses Completed: Jan 29, 1992

GENERAL MINERAL, PHYSICAL, INORGANIC, & RADIOLOGICAL CHEMICAL ANALYSES

System Name: Orion Environmental
System Number:
Name/No. of Sample Source: B-5

User ID: |___|___|___|
Station Number: |___|___|___|___|___|___|___|___|___|___|___|___|___|___|___|___|

Date/Time of Sample: |_9_|_2_|_0_|_1_|_1_|_3_|_-_|_-_|_-_|_-_|
Y Y M M D D T T T T

Laboratory Code: |_5_|_1_|_1_|_3_|

Date Analyses Completed: |_9_|_2_|_0_|_1_|_2_|_9_|
Y Y M M D D

Submitted by:
Phone #:

MCL/Reporting Units	Constituent	Entry #	Analyses Results
mg/L	Total Hardness (as CaC03)	00900	< 1.0
mg/L	Calcium (Ca)	00916	< 1.0
mg/L	Magnesium (Mg)	00927	< 1.0
mg/L	Sodium (Na)	00929	43
mg/L	Potassium (K)	00937	2.3
Total Cations	meq/L Value: --		
mg/L	Total Alkalinity (as CaC03)	00410	190
mg/L	Hydroxide (OH)	71830	< 0.10
mg/L	Carbonate (CO3)	00445	< 2.0
mg/L	Bicarbonate (HC03)	00440	190
* mg/L +	Sulfate (S04)	00945	29
* mg/L +	Chloride (Cl)	00940	68
45 mg/L	Nitrate (NO3)	71850	9.0
1.4-2.4 mg/L	Fluoride (F) Temp. Depend.	00951	< 0.10
Total Anions	meq/L Value: --		
Std Units	pH (Laboratory)	00403	7.1
** μmho/cm +	Specific Conductance (E.C.)	00095	550
*** mg/L +	Total Filterable Residue at 180 C (TDS)	70300	330
UNITS	Apparent Color (Unfiltered)	00081	< 3.0
TON	Odor Threshold at 60 C	00086	< 1.0
NTU	Lab Turbidity	82079	1.4
0.5 mg/L +	MBAS	38260	0.048

* 250-500-600 ** 900-1600-2200 *** 500-1000-1500

INORGANIC CHEMICALS

MCL/Reporting	Constituent	* DLR	Entry	Analyses
1000 µg/L	Aluminum (Al)	100	01105	< 100
50 µg/L	Arsenic (As)	10	01002	< 10
1000 µg/L	Barium (Ba)	100	01007	< 100
10 µg/L	Cadmium (Cd)	1	01027	< 1.0
50 µg/L	Chromium (Total Cr)	10	01034	< 10
1000 µg/L +	Copper (Cu)	50	01042	< 50
300 µg/L +	Iron (Fe)	100	01045	590
50 µg/L	Lead (Pb)	5	01051	< 5.0
50 µg/L +	Manganese (Mn)	30	01055	5600
2 µg/L	Mercury (Hg)	1	71900	< 1
10 µg/L	Selenium (Se)	5	01147	7.6
50 µg/L	Silver (Ag)	10	01077	< 10
5000 µg/L	Zinc (Zn)	50	01092	< 50

RADIOACTIVITY ANALYSES

15 pCi/l	Total Alpha	01501	1.6
pCi/l	Total Alpha Counting Error	01502	± 2.4
50 pCi/l	Total Beta	03501	1.7
pCi/l	Total Beta Counting Error	03502	± 3.3
20 pCi/l	Natural Uranium	28012	- -
pCi/l	Total Radium 226	09501	- -
pCi/l	Total Radium 226 Counting Error	09502	- -
pCi/l	Total Radium 228	11501	- -
pCi/l	Total Radium 228 Counting Error	11502	- -
5 pCi/l	Ra 226 + Ra 228	11503	- -
pCi/l	Ra 226 + Ra 228 Counting Error	11504	- -
pCi/l	Radon 222	82303	- -
pCi/l	Radon 222 Counting Error	82302	- -
20,000 pCi/l	Total Tritium	07000	- -
pCi/l	Total Tritium Counting Error	07001	- -
8 pCi/l	Total Strontium-90	13501	- -
pCi/l	Total Strontium-90 Counting Error	13502	- -

ADDITIONAL ANALYSES

NTU	Field Turbidity	82078	- -
C	SourceTemperature	00010	- -
	Langlier Index Source Temp.	71814	- -
	Langlier Index at 60 C	71813	- -
Std. Units	Field pH	00400	- -
	Aggressiveness Index	82383	- -
mg/L	Silica	00955	- -
mg/L	Phosphate	00650	- -
mg/L	Iodide	71865	- -
	Sodium Absorption Ratio	00931	- -
	Asbestos	81855	N.D.
	Boron	01020	- -

SEQUOIA ANALYTICAL

Nokowhat D. Herrera
Project Manager

+ indicates Secondary Drinking Water Standards

* Detection Limit for Reporting Purposes

SEQUOIA ANALYTICAL
680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Date of Report: Jan 29, 1992
Lab Name: Sequoia Analytical
Sampler Name: Michele Bellows
Employed by: Orion Environmental
Sample ID No.: 201-1546
Date/Time Sample Collected: 1/13/92
Date/Time Sample Received @ Lab: 1/13/92, 5:18pm
Date Analyses Completed: Jan 27, 1992

ORGANIC CHEMICAL ANALYSES

System Name: Orion Environmental
System Number: ____________
Name/No. of Sample Source: B1

User ID: |__|__|__|
Station Number: |__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|
Date/Time of Sample: |_9_|_2_|_0_|_1_|_1_|_3_|_-_|_-_|_-_|_-_| (Y Y M M D D T T T T)
Laboratory Code: |_5_|_1_|_1_|_3_|
Date Analyses Completed: |_9_|_2_|_0_|_1_|_2_|_7_| (Y Y M M D D)
Submitted by: ____________
Phone #: ____________

REGULATED ORGANIC CHEMICALS

Test Method	Constituent ALL CONSTITUENTS REPORTED µg/L	Entry #	Analyses Results	MCL µg/L	* DLR µg/L
EPA 502.2	Bromodichloromethane	32101	N.D.	- -	0.50
EPA 502.2	Bromoform	32104	N.D.	- -	0.50
EPA 502.2	Chloroform	32106	0.53	- -	0.50
EPA 502.2	Dibromochloromethane	32105	N.D.	- -	0.50
EPA 502.2	Total Trihalomethanes	82080	0.53	100	0.50
EPA 502.2	Benzene	34030	N.D.	1	0.50
EPA 502.2	Carbon tetrachloride	32102	N.D.	0.5	0.50
EPA 502.2	Ethyl benzene	34371	N.D.	680	5.0
EPA 502.2	1,4-Dichlorobenzene (p-DCB)	34571	N.D.	5	0.50
EPA 502.2	1,1-Dichloroethane (1,1-DCA)	34496	N.D.	5	0.50
EPA 502.2	1,2-Dichloroethane (1,2-DCA)	34531	N.D.	0.5	0.50
EPA 502.2	1,1-Dichloroethylene (1,1-DCE)	34501	N.D.	6	0.50
EPA 502.2	cis-1,2-Dichloroethylene	77093	N.D.	6	0.50
EPA 502.2	trans-1,2-Dichloroethylene	34546	N.D.	10	0.50
EPA 502.2	1,2-Dichloropropane	34541	N.D.	5.0	0.50
EPA 502.2	Total 1,3-Dichloropropene	34561	N.D.	0.5	0.50
EPA 502.2	Monochlorobenzene (Chlorobenzen	34301	N.D.	30	1.0
EPA 502.2	1,1,2,2-Tetrachloroethane	34516	N.D.	1	0.50
EPA 502.2	Tetrachloroethylene (PCE)	34475	N.D.	5	0.50
EPA 502.2	1,1,1-Trichloroethane (1,1,1-TCA)	34506	N.D.	200	1.0
EPA 502.2	1,1,2-Trichloroethane (1,1,2-TCA)	34511	N.D.	32	1.0
EPA 502.2	Trichloroethylene (TCE)	39180	N.D.	5	0.50

* Detection Limit for Reporting Purposes

REGULATED ORGANIC CHEMICALS CONTINUED

Test Method	Constituent ALL CONSTITUENTS REPORTED µg/L	Entry #	Analyses Results	MCL µg/L	* DLR µg/L
EPA 502.2	Trichlorofluoromethane (Freon 11)	34488	N.D.	150	1.0
EPA 502.2	Trichlorotrifluoroethane (Freon 113)	81611	N.D.	1200	10
EPA 502.2	Vinyl Chloride (VC)	39175	N.D.	0.5	0.50
EPA 502.2	m,p-Xylene	A-014	N.D.	- -	10
EPA 502.2	o-Xylene	77135	N.D.	- -	10
EPA 502.2	Total Xylenes (m,p & o)	81551	N.D.	1750	10
EPA 504	Dibromochloropropane (DBCP)	38761	- -	0.2	0.01
EPA 504	Ethylene Dibromide (EDB)	77651	- -	0.02	0.02
EPA 505	Endrin	39390	N.D.	0.2	0.1
EPA 505	Lindane (gamma-BHC)	39340	N.D.	4	0.2
EPA 505	Methoxychlor	39480	N.D.	100	10
EPA 505	Toxaphene	39400	N.D.	5	1.0
EPA 505	Chlordane	39350	N.D.	0.1	0.10
EPA 525	Diethylhexylphthalate (DEHP)	39100	-	4.0	0.01
EPA 505	Heptachlor	39410	N.D.	0.01	0.010
EPA 505	Heptachlor expoxide	39420	N.D.	0.01	0.010
EPA 507	Atrazine (AAtrex)	39033	- -	3	1.0
EPA 507	Molinate (Ordram)	82199	- -	20	2.0
EPA 507	Simazine (Princep)	39055	- -	10	1.0
EPA 507	Thiobencarb (Bolero)	A-001	- -	70	1.0
EPA 515.1	Bentazon (Basagran)	38710	N.D.	18	2.0
EPA 515.1	2,4-D	39730	N.D.	100	10
EPA 515.1	2,4,5-TP (Silvex)	39045	N.D.	10	1.0
EPA 531	Carbofuran (Furadan)	81405	- -	18	5.0
EPA 547	Glyphosate	79743	- -	700	25

UNREGULATED ORGANIC CHEMICALS

Test Method	Constituent ALL CONSTITUENTS REPORTED µg/L	Entry #	Analyses Results	MCL µg/L	* DLR µg/L
EPA 502.2	Bromobenzene	81555	N.D.	- -	0.50
EPA 502.2	Bromochloromethane	A-012	N.D.	- -	0.50
EPA 502.2	Bromomethane (Methyl Bromide)	34413	N.D.	- -	0.50
EPA 502.2	n-Butylbenzene	A-010	N.D.	- -	0.50
EPA 502.2	sec-Butylbenzene	77350	N.D.	- -	0.50
EPA 502.2	tert-Butylbenzene	77353	N.D.	- -	0.50
EPA 502.2	Chloroethane	34311	N.D.	- -	0.50
EPA 502.2	2-Chloroethylvinyl ether	34576	N.D.	- -	1.0
EPA 502.2	Chloromethane (Methyl Chloride)	34418	N.D.	- -	0.50
EPA 502.2	2-Chlorotoluene	A-008	N.D.	- -	0.50
EPA 502.2	4-Chlorotoluene	A-009	N.D.	- -	0.50
EPA 502.2	Dibromomethane	77596	N.D.	- -	0.50
EPA 502.2	1,2-Dichlorobenzene (o-DCB)	34536	N.D.	- -	0.50
EPA 502.2	1,3-Dichlorobenzene (m-DCB)	34566	N.D.	- -	0.50
EPA 502.2	Dichlorodifluoromethane	34668	N.D.	- -	1.0
EPA 502.2	1,3-Dichloropropane	77173	N.D.	- -	0.50
EPA 502.2	2,2-Dichloropropane	77170	N.D.	- -	0.50

UNREGULATED ORGANIC CHEMICALS CONTINUED

Test Method	Constituent ALL CONSTITUENTS REPORTED µg/L	Entry #	Analyses Results	MCL µg/L	* DLR µg/L
EPA 502.2	1,1-Dichloropropene	77168	N.D.	- -	0.50
EPA 502.2	Hexachlorobutadiene	34391	N.D.	- -	0.50
EPA 502.2	Isopropylbenzene (Cumene)	77223	N.D.	- -	0.50
EPA 502.2	p-Isopropyltoluene	A-011	N.D.	- -	0.50
EPA 502.2	Methylene chloride	34423	N.D.	- -	1.0
EPA 502.2	Naphthalene	34696	N.D.	- -	0.50
EPA 502.2	n-Propylbenzene	77224	N.D.	- -	0.50
EPA 502.2	Styrene	77128	N.D.	- -	0.50
EPA 502.2	1,1,1,2-Tetrachloroethane	77562	N.D.	- -	0.50
EPA 502.2	Toluene	34010	N.D.	- -	10
EPA 502.2	1,2,3-Trichlorobenzene	77613	N.D.	- -	0.50
EPA 502.2	1,2,4-Trichlorobenzene	34551	N.D.	- -	0.50
EPA 502.2	1,2,3-Trichloropropane	77443	N.D.	- -	0.50
EPA 502.2	1,2,4-Trimethylbenzene	77222	N.D.	- -	0.50
EPA 502.2	1,3,5-Trimethylbenzene	77336	N.D.	- -	0.50
EPA 524.2	Methyl ethyl ketone (MEK, Butanone	81595	- -	- -	5.0
EPA 524.2	Methyl isobutyl ketone (MIBK)	81596	- -	- -	5.0
EPA 525	bis (2-Chloroethyl) Ether	34273	- -	- -	5.0

EPA 505	Alachlor (Alanex)	77825	N.D.	- -	1.0
EPA 507	Bromacil (Hyvar)	82198	- -	- -	10
EPA 507	Diazinon	39570	- -	- -	0.02
EPA 507	Prometryn (Caparol)	39057	- -	- -	2.0
EPA 508	Chlorothalonil (Daconil, Bravo)	70314	- -	- -	5.0
EPA 507	Dimethoate (Cygon)	38458	- -	- -	10
EPA 531	Aldicarb (Temik)	39053	- -	- -	3.0
EPA 508	Diuron	39650	- -	- -	1.0

Note and describe any additional compounds found: ____________________

SEQUOIA ANALYTICAL

Nokowhat D. Herrera
Project Manager

SEQUOIA ANALYTICAL
680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

Date of Report: Jan 29, 1992
Lab Name: Sequoia Analytical
Sampler Name: Michele Bellows
Employed by: Orion Environmental
Sample ID No.: 201-1547
Date/Time Sample Collected: 1/13/92
Date/Time Sample Received @ Lab: 1/13/92, 5:18 pm
Date Analyses Completed: Jan 27, 1992

ORGANIC CHEMICAL ANALYSES

System Name: Orion Environmental
System Number:
Name/No. of Sample Source: B5

User ID: |__|__|__|
Station Number: |__|__|__|__|__|__|__|__|__|__|__|__|__|__|

Date/Time of Sample:

Y	Y	M	M	D	D	T	T	T	T
9	2	0	1	1	3	-	-	-	-

Laboratory Code: |_5_|_1_|_1_|_3_|

Date Analyses Completed:

Y	Y	M	M	D	D
9	2	0	1	2	7

Submitted by:
Phone #:

REGULATED ORGANIC CHEMICALS

Test Method	Constituent ALL CONSTITUENTS REPORTED µg/L	Entry #	Analyses Results	MCL µg/L	* DLR µg/L
EPA 502.2	Bromodichloromethane	32101	N.D.	--	0.50
EPA 502.2	Bromoform	32104	N.D.	--	0.50
EPA 502.2	Chloroform	32106	N.D.	--	0.50
EPA 502.2	Dibromochloromethane	32105	N.D.	--	0.50
EPA 502.2	Total Trihalomethanes	82080	N.D.	100	0.50
EPA 502.2	Benzene	34030	N.D.	1	0.50
EPA 502.2	Carbon tetrachloride	32102	N.D.	0.5	0.50
EPA 502.2	Ethyl benzene	34371	N.D.	680	5.0
EPA 502.2	1,4-Dichlorobenzene (p-DCB)	34571	N.D.	5	0.50
EPA 502.2	1,1-Dichloroethane (1,1-DCA)	34496	N.D.	5	0.50
EPA 502.2	1,2-Dichloroethane (1,2-DCA)	34531	N.D.	0.5	0.50
EPA 502.2	1,1-Dichloroethylene (1,1-DCE)	34501	N.D.	6	0.50
EPA 502.2	cis-1,2-Dichloroethylene	77093	N.D.	6	0.50
EPA 502.2	trans-1,2-Dichloroethylene	34546	N.D.	10	0.50
EPA 502.2	1,2-Dichloropropane	34541	N.D.	5.0	0.50
EPA 502.2	Total 1,3-Dichloropropene	34561	N.D.	0.5	0.50
EPA 502.2	Monochlorobenzene (Chlorobenzen	34301	N.D.	30	1.0
EPA 502.2	1,1,2,2-Tetrachloroethane	34516	N.D.	1	0.50
EPA 502.2	Tetrachloroethylene (PCE)	34475	N.D.	5	0.50
EPA 502.2	1,1,1-Trichloroethane (1,1,1-TCA)	34506	N.D.	200	1.0
EPA 502.2	1,1,2-Trichloroethane (1,1,2-TCA)	34511	N.D.	32	1.0
EPA 502.2	Trichloroethylene (TCE)	39180	N.D.	5	0.50

* Detection Limit for Reporting Purposes

REGULATED ORGANIC CHEMICALS CONTINUED

Test Method	Constituent ALL CONSTITUENTS REPORTED μg/L	Entry #	Analyses Results	MCL μg/L	* DLR μg/L
EPA 502.2	Trichlorofluoromethane (Freon 11)	34488	N.D.	150	1.0
EPA 502.2	Trichlorotrifluoroethane (Freon 113)	81611	N.D.	1200	10
EPA 502.2	Vinyl Chloride (VC)	39175	N.D.	0.5	0.50
EPA 502.2	m,p-Xylene	A-014	N.D.	- -	10
EPA 502.2	o-Xylene	77135	N.D.	- -	10
EPA 502.2	Total Xylenes (m,p & o)	81551	N.D.	1750	10
EPA 504	Dibromochloropropane (DBCP)	38761	- -	0.2	0.01
EPA 504	Ethylene Dibromide (EDB)	77651	- -	0.02	0.02
EPA 505	Endrin	39390	N.D.	0.2	0.10
EPA 505	Lindane (gamma-BHC)	39340	N.D.	4	0.20
EPA 505	Methoxychlor	39480	N.D.	100	10
EPA 505	Toxaphene	39400	N.D.	5	1.0
EPA 505	Chlordane	39350	N.D.	0.1	0.10
EPA 525	Diethylhexylphthalate (DEHP)	39100	-	4.0	0.050
EPA 505	Heptachlor	39410	N.D.	0.01	0.010
EPA 505	Heptachlor expoxide	39420	N.D.	0.01	0.010
EPA 507	Atrazine (AAtrex)	39033	- -	3	1.0
EPA 507	Molinate (Ordram)	82199	- -	20	2.0
EPA 507	Simazine (Princep)	39055	- -	10	1.0
EPA 507	Thiobencarb (Bolero)	A-001	- -	70	1.0
EPA 515.1	Bentazon (Basagran)	38710	N.D.	18	2.0
EPA 515.1	2,4-D	39730	N.D.	100	10
EPA 515.1	2,4,5-TP (Silvex)	39045	N.D.	10	1.0
EPA 531	Carbofuran (Furadan)	81405	- -	18	5.0
EPA 547	Glyphosate	79743	- -	700	25

UNREGULATED ORGANIC CHEMICALS

Test Method	Constituent ALL CONSTITUENTS REPORTED μg/L	Entry #	Analyses Results	MCL μg/L	* DLR μg/L
EPA 502.2	Bromobenzene	81555	N.D.	- -	0.50
EPA 502.2	Bromochloromethane	A-012	N.D.	- -	0.50
EPA 502.2	Bromomethane (Methyl Bromide)	34413	N.D.	- -	0.50
EPA 502.2	n-Butylbenzene	A-010	N.D.	- -	0.50
EPA 502.2	sec-Butylbenzene	77350	N.D.	- -	0.50
EPA 502.2	tert-Butylbenzene	77353	N.D.	- -	0.50
EPA 502.2	Chloroethane	34311	N.D.	- -	0.50
EPA 502.2	2-Chloroethylvinyl ether	34576	N.D.	- -	1.0
EPA 502.2	Chloromethane (Methyl Chloride)	34418	N.D.	- -	0.50
EPA 502.2	2-Chlorotoluene	A-008	N.D.	- -	0.50
EPA 502.2	4-Chlorotoluene	A-009	N.D.	- -	0.50
EPA 502.2	Dibromomethane	77596	N.D.	- -	0.50
EPA 502.2	1,2-Dichlorobenzene (o-DCB)	34536	N.D.	- -	0.50
EPA 502.2	1,3-Dichlorobenzene (m-DCB)	34566	N.D.	- -	0.50
EPA 502.2	Dichlorodifluoromethane	34668	N.D.	- -	1.0
EPA 502.2	1,3-Dichloropropane	77173	N.D.	- -	0.50
EPA 502.2	2,2-Dichloropropane	77170	N.D.	- -	0.50

UNREGULATED ORGANIC CHEMICALS CONTINUED

Test Method	Constituent ALL CONSTITUENTS REPORTED µg/L	Entry #	Analyses Results	MCL µg/L	* DLR µg/L
EPA 502.2	1,1-Dichloropropene	77168	N.D.	--	0.50
EPA 502.2	Hexachlorobutadiene	34391	N.D.	--	0.50
EPA 502.2	Isopropylbenzene (Cumene)	77223	N.D.	--	0.50
EPA 502.2	p-Isopropyltoluene	A-011	N.D.	--	0.50
EPA 502.2	Methylene chloride	34423	N.D.	--	1.0
EPA 502.2	Naphthalene	34696	N.D.	--	0.50
EPA 502.2	n-Propylbenzene	77224	N.D.	--	0.50
EPA 502.2	Styrene	77128	N.D.	--	0.50
EPA 502.2	1,1,1,2-Tetrachloroethane	77562	N.D.	--	0.50
EPA 502.2	Toluene	34010	N.D.	--	10
EPA 502.2	1,2,3-Trichlorobenzene	77613	N.D.	--	0.50
EPA 502.2	1,2,4-Trichlorobenzene	34551	N.D.	--	0.50
EPA 502.2	1,2,3-Trichloropropane	77443	N.D.	--	0.50
EPA 502.2	1,2,4-Trimethylbenzene	77222	N.D.	--	0.50
EPA 502.2	1,3,5-Trimethylbenzene	77336	N.D.	--	0.50
EPA 524.2	Methyl ethyl ketone (MEK, Butanone	81595	--	--	5.0
EPA 524.2	Methyl isobutyl ketone (MIBK)	81596	--	--	5.0
EPA 525	bis (2-Chloroethyl) Ether	34273	--	--	5.0
EPA 505	Alachlor (Alanex)	77825	N.D.	--	1.0
EPA 507	Bromacil (Hyvar)	82198	--	--	10
EPA 507	Diazinon	39570	--	--	0.02
EPA 507	Prometryn (Caparol)	39057	--	--	2.0
EPA 508	Chlorothalonil (Daconil, Bravo)	70314	--	--	5.0
EPA 507	Dimethoate (Cygon)	38458	--	--	10
EPA 531	Aldicarb (Temik)	39053	--	--	3.0
EPA 508	Diuron	39650	--	--	1.0

Note and describe any additional compounds found: ______________________

SEQUOIA ANALYTICAL

Nokowhat D. Herrera
Project Manager

SEQUOIA ANALYTICAL
680 Chesapeake Drive • Redwood City, CA 94063
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Orion Environmental
315 Washington
Oakland, CA 94607
Attention: Michele Bellows

Client Project ID: Lake Merced Transport
Sample Descript: See below
Analysis Method: Membrane Filtration
First Sample #: 201-1546

Reported: Jan 29, 1992

BACTERIOLOGICAL ANALYSIS: TOTAL COLIFORM

Sample Number	Date Sampled and Received	Sample Description	Total Coliform Bacteria CFU/100 mL
201-1546	1/13/92	B-1	3.0
201-1547	1/13/92	B-5	20

SEQUOIA ANALYTICAL

Nokowhat D. Herrera
Project Manager

Please Note:
The State of California Drinking Water Standard is less than one Colony Forming Unit (CFU) per 100 mL

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Orion Environmental
315 Washington
Oakland, CA 94607
Attention: Michele Bellows

Client Project ID: Lake Merced Transport
Sample Descript: Water
Analyses for: Free Chlorine Residual
First Sample #: 201-1546

Sampled: Jan 13, 1992
Received: Jan 13, 1992
Reported: Jan 29, 1992

LABORATORY ANALYSES

Sample Number	Sample Description	Detection Limit mg/L	Sample Result mg/L
201-1546	B-1	0.10	N.D.
201-1547	B-5	0.10	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

N. D. H

Nokowhat D. Herrera
Project Manager

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Attention: Michele Bellows

Client Project ID: Lake Merced Transport

QC Sample Group: 2011546 - 47

Reported: Jan 29, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	Mercury	Barium	Cadmium	Chromium	Copper	Silver	Zinc
Method:	EPA 245.1	EPA 200.7	EPA 200.7	200.7/213.2	EPA 200.7	EPA 200.7	EPA 200.7
Analyst:	J.Martinez	C.Medefesser	C.Medefesser	C.Medefesser	C.Medefesser	C.Medefesser	C.Medefesser
Reporting Units:	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Date Analyzed:	Jan 17, 1992	Jan 17, 1992	Jan 17, 1992	Jan 17, 1992	Jan 17, 1992	Jan 17, 1992	Jan 17, 1992
QC Sample #:	201-1729	201-1731	201-1731	201-1731	201-1731	201-1731	201-1731
Sample Conc.:	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	2.0	1000	1000	1000	1000	1000	1000
Conc. Matrix Spike:	1.6	1100	1100	1000	1000	850	1000
Matrix Spike % Recovery:	80	110	110	100	100	85	100
Conc. Matrix Spike Dup.:	1.6	1100	1100	1000	1000	860	1000
Matrix Spike Duplicate % Recovery:	80	110	110	100	100	86	100
Relative % Difference:	0.0	0.0	0.0	0.0	0.0	1.2	0.0

SEQUOIA ANALYTICAL

Nokowhat D. Herrera
Project Manager

% Recovery:
$$\frac{\text{Conc. of M.S.} - \text{Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$$

Relative % Difference:
$$\frac{\text{Conc. of M.S.} - \text{Conc. of M.S.D.}}{(\text{Conc. of M.S.} + \text{Conc. of M.S.D.})\ /\ 2} \times 100$$

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Client Project ID: Lake Merced Transport

QC Sample Group: 2011546 - 47

Reported: Jan 29, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	Sodium	Iron	Manganese	Aluminum	Potassium
Method:	EPA 200.7	EPA 200.7	EPA 200.7	EPA 200.7	EPA 200.7
Analyst:	C.Medefesser	C.Medefesser	C.Medefesser	C.Medefesser	C.Medefesser
Reporting Units:	mg/L	μg/L	μg/L	μg/L	mg/L
Date Analyzed:	Jan 17, 1992	Jan 17, 1992	Jan 17, 1992	Jan 17, 1992	Jan 17, 1992
QC Sample #:	201-1731	201-1731	201-1731	201-1731	201-1731
Sample Conc.:	69	910	1200	.820	1.2
Spike Conc. Added:	100	1000	1000	1000	1.0
Conc. Matrix Spike:	160	1900	2200	1800	2.4
Matrix Spike % Recovery:	91	99	100	98	120
Conc. Matrix Spike Dup.:	160	1900	2200	1800	2.4
Matrix Spike Duplicate % Recovery:	91	99	100	108	120
Relative % Difference:	0.0	0.0	0.0	5.4	0.0

SEQUOIA ANALYTICAL

N. K. D. He

Nokowhat D. Herrera
Project Manager

% Recovery: $$\frac{\text{Conc. of M.S. - Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$$

Relative % Difference: $$\frac{\text{Conc. of M.S. - Conc. of M.S.D.}}{\text{(Conc. of M.S. + Conc. of M.S.D.) / 2}} \times 100$$

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Reported: Jan 29, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	Lead	Arsenic	Selenium	Cadmium
Method:	EPA 239.2	EPA 206.2	EPA 270.2	EPA 213.2
Analyst:	M. Mistry	F.Contreras	F.Contreras	K.Newberry
Reporting Units:	µg/L	µg/L	µg/L	µg/L
Date Analyzed:	Jan 17, 1992	Jan 24, 1992	Jan 24, 1992	Jan 24, 1992
QC Sample #:	201-1728	201-2691	201-2691	201-2168
Sample Conc.:	N.D.	15	14	0.13
Spike Conc. Added:	1000	100	100	2.0
Conc. Matrix Spike:	1000	0.96	120	2.1
Matrix Spike % Recovery:	100	81	106	98
Conc. Matrix Spike Dup.:	980	93	120	2.2
Matrix Spike Duplicate % Recovery:	98	78	106	104
Relative % Difference:	2.0	3.2	0.0	4.6

SEQUOIA ANALYTICAL

Nokowhat D. Herrera
Project Manager

% Recovery: $$\frac{\text{Conc. of M.S. - Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$$

Relative % Difference: $$\frac{\text{Conc. of M.S. - Conc. of M.S.D.}}{\text{(Conc. of M.S. + Conc. of M.S.D.) / 2}} \times 100$$

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QC Sample Group: 2011546 - 47
Reported: Jan 29, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	Nitrate as N	Sulfate	Surfactants	Chloride	Turbidity	pH	Conductivity
Method:	EPA 300.0	EPA 300.0	EPA 425.1	EPA 300.0	EPA 180.1	EPA 9040	EPA 120.1
Analyst:	P.Penner	P.Penner	B.Samra	P.Penner	V.Ankaitis	Y. Arteaga	Y. Arteaga
Reporting Units:	mg/L	mg/L	mg/L	mg/L	NTU	N.A.	omhos/cm
Date Analyzed:	Jan 14, 1992	Jan 14, 1992	Jan 15, 1992	Jan 16, 1992	Jan 14, 1992	Jan 14, 1992	Jan 14, 1992
QC Sample #:	201-1545	201-1545	Blank	201-1547	201-1507	201-1540	201-1611
Sample Conc.:	N.D.	22	N.D.	68	0.26	7.0	700
Spike Conc. Added:	100	100	0.050	100	2.0	N.A.	710
Conc. Matrix Spike:	100	120	0.035	170	2.0	N.A.	1400
Matrix Spike % Recovery:	100	98	70	102	87	N.A.	99
Conc. Matrix Spike Dup.:	100	120	0.036	170	2.0	7.0	1400
Matrix Spike Duplicate % Recovery:	100	98	72	102	87	N.A.	99
Relative % Difference:	0.0	0.0	2.6	0.0	0.0	0.0	0.0

SEQUOIA ANALYTICAL

Nokowhat D. Herrera
Project Manager

% Recovery: $$\frac{\text{Conc. of M.S. - Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$$

Relative % Difference: $$\frac{\text{Conc. of M.S. - Conc. of M.S.D.}}{\text{(Conc. of M.S. + Conc. of M.S.D.) / 2}} \times 100$$

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QC Sample Group: 2011546 - 47

Reported: Jan 29, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	Ttl. Dissolved Solids	Fluoride	Alkalinity	Hardness
Method:	EPA 160.1	EPA 340.2	SM2320	SM2340
Analyst:	Y. Arteaga	P.Penner	E.King	E.King
Reporting Units:	mg/L	mg/L	mg/L	mg/L
Date Analyzed:	Jan 14, 1992	Jan 28, 1992	Jan 22, 1992	Jan 22, 1992
QC Sample #:	201-1555	201-2059	201-2059	201-2464
Sample Conc.:	1700	0.26	N.D.	680
Spike Conc. Added:	N.A.	1.0	N.A.	N.A.
Conc. Matrix Spike:	N.A.	1.2	N.A.	N.A.
Matrix Spike % Recovery:	N.A.	94	N.A.	N.A.
Conc. Matrix Spike Dup.:	1,700	1.2	130	670
Matrix Spike Duplicate % Recovery:	N.A.	94	N.A.	N.A.
Relative % Difference:	0.0	0.0	0.0	1.5

SEQUOIA ANALYTICAL

Nokowhat D. Herrera
Project Manager

% Recovery: $\frac{\text{Conc. of M.S. - Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$

Relative % Difference: $\frac{\text{Conc. of M.S. - Conc. of M.S.D.}}{\text{(Conc. of M.S. + Conc. of M.S.D.) / 2}} \times 100$

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Client Project ID: Lake Merced Transport

QC Sample Group: 2011546 - 47

Reported: Jan 29, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	1,1-Dichloro-ethene	Trichloro-ethene	Chloro-benzene	Benzene	Toluene	Chloro-benzene
Method:	EPA 502.2	EPA 502.2	EPA 502.2	EPA 502.2	EPA 502.2	EPA 502.2
Analyst:	L.Duong	L.Duong	L.Duong	L.Duong	L.Duong	L.Duong
Reporting Units:	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L
Date Analyzed:	Jan 27, 1992	Jan 27, 1992	Jan 27, 1992	Jan 27, 1992	Jan 27, 1992	Jan 27, 1992
QC Sample #:	201-2631	201-2631	201-2631	201-2631	201-2631	201-2631
Sample Conc.:	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Spike Conc. Added:	50	50	50	50	50	50
Conc. Matrix Spike:	5.0	4.7	3.7	4.9	5.1	5.7
Matrix Spike % Recovery:	100	94	74	98	102	114
Conc. Matrix Spike Dup.:	6.4	5.3	4.2	5.5	5.7	6.2
Matrix Spike Duplicate % Recovery:	128	106	84	110	114	124
Relative % Difference:	25	12	13	12	11	8.0

SEQUOIA ANALYTICAL

Nokowhat D. Herrera
Project Manager

% Recovery: $\frac{\text{Conc. of M.S. - Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$

Relative % Difference: $\frac{\text{Conc. of M.S. - Conc. of M.S.D.}}{\text{(Conc. of M.S. + Conc. of M.S.D.) / 2}} \times 100$

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Client Project ID: Lake Merced Transport
QC Sample Group: 2011546 - 47

Reported: Jan 29, 1992

QUALITY CONTROL DATA REPORT

ANALYTE	2,4-D	2,4,5-TP	2,4,5-T
Method:	EPA 515	EPA 515	EPA 515
Analyst:	D.T.	D.T.	D.T.
Reporting Units:	µg/L	µg/L	µg/L
Date Analyzed:	Jan 15, 1992	Jan 15, 1992	Jan 15, 1992
QC Sample #:	BLK011392	BLK011392	BLK011392
Sample Conc.:	N.D.	N.D.	N.D.
Spike Conc. Added:	1200	400	400
Conc. Matrix Spike:	1200	240	370
Matrix Spike % Recovery:	100	60	93
Conc. Matrix Spike Dup.:	840	24	340
Matrix Spike Duplicate % Recovery:	70	60	85
Relative % Difference:	35	0.0	8.5

SEQUOIA ANALYTICAL

Nokowhat D. Herrera
Project Manager

% Recovery: $\dfrac{\text{Conc. of M.S. - Conc. of Sample}}{\text{Spike Conc. Added}} \times 100$

Relative % Difference: $\dfrac{\text{Conc. of M.S. - Conc. of M.S.D.}}{\text{(Conc. of M.S. + Conc. of M.S.D.) / 2}} \times 100$

COPY

CHAIN OF CUSTODY REPORT

SEQUOIA ANALYTICAL
680 CHESAPEAKE DRIVE
REDWOOD CITY, CA 94063 ATTN:
PHONE: 364-9600 FAX: 364-9233

PROJECT NAME/SITE: Lake Merced Transport

SAMPLER: Bellows DATE: 1-13-92

REPORT TO: Michele Bellows

BILLING TO: Orion Environmental
315 Washington
Oakland CA 94607

PO#/BILLING REFERENCE: Lake Merced Transport

TURNAROUND TIME:

		8 HR.
24 HR.	48 HR.	72 HR.
5 DAY	10 DAY	15 DAY ✓

ANALYSIS REQUESTED

SAMPLE NUMBER	SAMPLE DESCRIPTION	NUMBER OF CONT.	TYPE CONT.	SAMPLING TIME/DATE	General Physical	Bac T	Organic Chems	Inorganic	Radionuclide	Strontium	Tritium	Chloride	Copper	Surfactants	See other sheet (14)	REMARKS	SAMPLE ID#/ STATION
1	B-1	8	VOA	1/13	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	2011546	
																↓	
2	B-5	8		1-13	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	↓ 47	

RELINQUISHED FROM SEQUOIA BY: Bellows DATE 1/13/92 TIME: 1718
RECEIVED BY: A. Nagra

RELINQUISHED BY: DATE TIME:
RECEIVED BY:

RELINQUISHED BY: DATE TIME:
RECEIVED IN LAB BY:

TRAVEL TI
ON SITE T
OTHER:
WERE SAMPL
PRESERVED
IN GOOD CONDITION?

Orion
Environmental
763-1355

2nd Sheet

Lake Merced Tran

COPY

Iron	✓	✓
Manganese	✓	✓
Conductivity	✓	✓
Sulfate	✓	✓
TDS	✓	✓
Zinc	✓	✓
Alkalinity ($CaCO_3$)	✓	✓
Asbestos	✓	✓
Calcium	✓	✓
Chlorine (Free)	✓	✓
Hardness	✓	✓
pH	✓	✓
Potassium	✓	✓
Sodium	✓	✓

Rec'd by:

Rec'd by: A. Nagle.
1/13/92 : 1725

FEDERAL AND STATE DRINKING WATER STANDARDS

TABLE 1-1
WATER QUALITY STANDARDS FOR DRINKING WATER
(current as of January 1993)
(continued)

			U.S. Environmental Protection Agency				California Department of Health Services		
PARAMETER			MCL	MCL	MCLG	MCLG		MCL	Action
	UNIT	P/S(a)	Existing	Proposed	Existing	Proposed	MCL	Proposed	Levels
PHYSICAL/AESTHETIC									
Algae ID/Enumerate	-	-	-	-	-	-	-	-	-
Chlorophyll A	-	-	-	-	-	-	-	-	-
COD	-	-	-	-	-	-	-	-	-
Color	unit	S	15	-	-	-	15	-	-
Corrosivity - Langelier Index	-	S	non-corrosive	-	-	-	relatively low	-	-
DO	-	-	-	-	-	-	-	-	-
Fluorescence	-	-	-	-	-	-	-	-	-
Foaming agents (MBAS)	mg/L	S	0.5	-	-	-	0.5	-	-
Geosmin/MIB	-	-	-	-	-	-	-	-	-
Hardness (as CaCO3)	-	-	-	-	-	-	-	-	-
Odor	TON	S		3	-	-	3	-	-
pH	unit	S		6.5-8.5	-	-	-	-	-
PSD	-	-	-	-	-	-	-	-	-
Settled Solids	-	-	-	-	-	-	-	-	-
Specific Conductance	µmho/cm	S	-	-	-	-	900(c)	-	-
Taste	-	-	-	-	-	-	-	-	-
Temperature	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	S		500	-	-	500(c)	-	-
Total Suspendend Solids	-	-	-	-	-	-	-	-	-
Turbidity	NTU	P	0.5-1(d,e)	-	-	-	0.5/5(f)	-	-
RADIOLOGICAL									
Adj. Gross Alpha Emitters (excl. Ra-226, U, and Rn-222)	pCi/L	P	15	15	-	0	15	-	-
Beta and Photon Emitters (excl. Ra-228)	pCi/L	P	(h)	(h)	-	0	50	-	-
Radium-226	pCi/L	P	5	20	-	0	5	-	-
Radium-228	pCi/L	P	5	20	-	0	5	-	-
Radon-222	pCi/L	P	-	300	-	0	-	-	-
Strontium-90	pCi/L	P	-	-	-	-	8	-	-
Tritium	pCi/L	P	-	-	-	-	20,000	-	-
Uranium	pCi/L	P	-	30 (l)	-	0	20	-	-
MICROBIOLOGICAL									
Bacterial Speciation	-	-	-	-	-	-	-	-	-
Bioassay	-	-	-	-	-	-	-	-	-
Fecal Coliform - MPN	MPN/100ml	P	absent(j)	-	-	-	absent(j)	(k)	-
Fecal Streptococci	-	-	-	-	-	-	-	-	-
Giardia lamblia	-	P	99.9% rem/inact(d,e)	-	-	-	99.9% rem/inact(d,e)	(k)	-
Heterotrophic Plate Count	CFU/ml	P	(d,e,i)	-	-	-	(d,e)	(k)	-
Legionella	-	P	(d,e)	-	-	-	(d,e)	(k)	-
Total Coliform - MF, MPN, Presence/Absence	(m)	P	absent(d, l)	-	0	-	>95% absent(j,q)	-	-
Viruses	-	P	99.99% rem/inact(d,e)	-	-	-	99.99% rem/inact(d,e)	(k)	-

TABLE 1-1
WATER QUALITY STANDARDS FOR DRINKING WATER
(current as of January 1993)
(continued)

PARAMETER			U.S. Environmental Protection Agency				California Department of Health Services		
			MCL	MCL	MCLG	MCLG		MCL	Action
	UNIT	P/S(a)	Existing	Proposed	Existing	Proposed	MCL	Proposed	Levels
INORGANIC									
Alkalinity (change)	-	-	-	-	-	-	-	-	-
Aluminum (particulate and dissolved)	mg/L	P	-/0.02 (l)	(l)/0.05 (l)	-	(l)	1	1.0	-
Ammonia	-	-	-	(v)	-	-	-	-	-
Antimony	mg/L	P	-	0.01/0.005 (at)	-	0.003 (as)	-	-	-
Arsenic	mg/L	P	0.05	0.03 (draft)	-	0 (draft)	0.05	future review	-
Asbestos - water (x)	MFL	P	7	-	7	-	-	-	-
Barium	mg/L	P	2	-	2	-	1	-	-
Beryllium	mg/L	P	-	0.001 (as)	-	0 (as)	-	-	-
Boron	-	-	-	-	-	-	-	-	-
Bromide	-	-	-	-	-	-	-	-	-
Cadmium	mg/L	P	0.005	-	0.005	-	0.01	-	-
Calcium	-	-	-	-	-	-	-	-	-
Cesium	-	-	-	-	-	-	-	-	-
Chloride	mg/L	S	250	-	-	-	250(c)	-	-
Chromium (total)	mg/L	P	0.1	-	0.1	-	0.05	-	-
Cobalt	-	-	-	-	-	-	-	-	-
Copper	mg/L	AL	1.3 (z)	-	1.3	-	-/1 (f)	-	-
Cyanide	mg/L	P	-	0.2 (as)	-	0.2 (as)	-	-	-
Fluoride	mg/L	P	4/2(d,f)	-	4	-	1.4-2.4 (temp dep)	-	-
Hydrogen Sulfide	mg/L	S	0.05	-	-	-	-	-	-
Iron	mg/L	S	0.3	-	-	-	0.3	-	-
Lead	mg/L	AL	0.015 (z)	-	0	-	0.05	0	-
Magnesium	-	-	-	-	-	-	-	-	-
Manganese	mg/L	S	0.05	-	-	-	0.05	-	-
Mercury	mg/L	P	0.002	-	0.002	-	0.002	-	-
Molybdenum	-	-	-	(t)	-	(t)	-	-	-
Nickel	mg/L	P	-	0.1 (as)	-	0.1 (as)	-	-	-
Nitrate (as N)	mg/L	P	10	10(aa)	10	-	-	-	-
Nitrate (as NO3)	mg/L	P	-	-	-	-	45	-	-
Nitrite (as N)	mg/L	P	1	-	1	-	-	-	-
Phosphorus - Total, Ortho	-	-	-	-	-	-	-	-	-
Selenium	mg/L	P	0.05	-	0.05	-	0.01	future review	-
Silica Dioxide	-	-	-	-	-	-	-	-	-
Silver	mg/L	P	0.05/01 (f)	(t)/0.09(f)	-	(t)	0.05	-	-
Sodium	-	-	(ar)	(t)	-	(t)	-	-	-
Sulfate	mg/L	P	- /250 (f)	400/500 (at)	-	400/500 (at)	250(c,f)	-	-
Tannin	-	-	-	-	-	-	-	-	-
Thallium	mg/L	P	-	0.002/0.001 (at)	-	0.0005 (as)	-	-	-
Vanadium	-	-	-	(t)	-	(t)	-	-	-
Zinc	mg/L	S	5	(t)	-	(t)	5	-	-

TABLE 1-1
WATER QUALITY STANDARDS FOR DRINKING WATER
(current as of January 1993)
(continued)

			U.S. Environmental Protection Agency				California Department of Health Services		
PARAMETER			MCL	MCL	MCLG	MCLG		MCL	Action
	UNIT	P/S(a)	Existing	Proposed	Existing	Proposed	MCL	Proposed	Levels
ORGANIC									
Assimilable Organic Carbon (AOC)	-	-	-	(ab)	-	-	-	-	-
THMFP (THM Formation Potential)	-	-	-	-	-	-	-	-	-
Total Organic Carbon (TOC)	-	-	-	-	-	-	-	-	-
Total Organic Halogen (TOX)	-	-	-	-	-	-	-	-	-
total Trihalomethanes (tTHMs)	µg/L	P	100	(ac)	-	-	100	-	-
Regulated VOCs									
Benzene	µg/L	P	5 (d)	-	0	-	1	-	-
Carbon Tetrachloride (CTC)	µg/L	P	5 (d)	-	0	-	0.5	-	-
m-Dichlorobenzene (m-DCB; 1,3-DCB)	µg/L	P	-	(ae)	-	-	MNTR-A	-	130/20(f,al)
o-Dichlorobenzene (o-DCB; 1,2-DCB)	µg/L	P	600	-/10(f)	600	-	MNTR-A	-	130/10(f,al)
p-Dichlorobenzene (p-DCB; 1,4-DCB)	µg/L	P	75 (d)	-/5(f)	75	-	5	-	-
1,2-Dichloroethane (1,2-DCA)	µg/L	P	5 (d)	-	0	-	0.5	-	-
1,1-Dichloroethylene (1,1-DCE)	µg/L	P	7 (d)	-	7	-	6	-	-
cis-1,2-Dichloroethylene	µg/L	P	70	-	70	-	6	-	-
trans-1,2-Dichloroethylene	µg/L	P	100	-	100	-	10	-	-
Methylene Chloride (dichloromethane)	µg/L	P	-	5 (as)	-	0 (as)	MNTR-A	future review	40
Monochlorobenzene	µg/L	P	100	-/10(f)	100	-	30	-	-
Tetrachloroethylene (PCE)	µg/L	P	5	-	0	-	5	-	-
1,2,3-Trichlorobenzene	-	-	-	(l)	-	(l)	MNTR-B	-	-
1,2,4-Trichlorobenzene	µg/L	P	-	9 (as)	-	9 (as)	MNTR-B	-	-
1,1,1-Trichloroethane (1,1,1-TCA)	µg/L	P	200 (d)	-	200	-	200	-	-
Trichloroethylene (TCE)	µg/L	P	5 (d)	-	0	-	5	-	-
Vinyl Chloride	µg/L	P	2 (d)	-	0	-	0.5	-	-

TABLE 1-1
WATER QUALITY STANDARDS FOR DRINKING WATER
(current as of January 1993)
(continued)

PARAMETER	UNIT	P/S(a)	U.S. Environmental Protection Agency MCL Existing	MCL Proposed	MCLG Existing	MCLG Proposed	California Department of Health Services MCL	MCL Proposed	Action Levels
Regulated SOCs									
Acrylamide	µg/L	P	-	(ah)	-	0	-	-	-
Adipates (Di(ethylhexyl)adipate)	µg/L	P	-	500 (as)	-	500 (as)	-	-	-
Alachlor	µg/L	P	2	-	0	-	MNTR-B	-	0.2
Aldicarb	µg/L	P	3	-	1	-	MNTR-B	-	10
Aldicarb sulfone	µg/L	P	3	-	1	-	-	-	-
Aldicarb sulfoxide	µg/L	P	4	-	1	-	-	-	-
Atrazine	µg/L	P	3	-	3	-	3	-	-
Carbofuran	µg/L	P	40	-	40	-	18	-	-
Chlordane	µg/L	P	2	-	0	-	0.1	-	0.1
Dalapon	µg/L	P	-	200 (as)	-	200 (as)	-	-	-
1,2-Dibromo-3-chloropropane (DBCP)	µg/L	P	0.2	-	0	-	0.2	-	-
Dibromomethane	-	-	-	(f)	-	(f)	MNTR-A	-	-
1,2-Dichloropropane	µg/L	P	5	-/5(f)	0	-	5	-	-
Dinoseb	µg/L	P	-	7 (as)	-	7 (as)	-	-	-
Diquat	µg/L	P	-	20 (as)	-	20 (as)	-	-	-
2,4-Dichlorophenoxyacetic acid (2,4-D)	µg/L	P	70	-	-	70	100	-	-
Endothall	µg/L	P	-	100 (as)	-	100 (as)	-	-	-
Endrin	µg/L	P	0.2	2 (as)	-	2 (as)	0.2	-	-
Epichlorohydrin	µg/L	P	BAT	-	0	-	-	-	-
Ethylene dibromide (EDB)	µg/L	P	0.05	-	0	-	0.02	-	-
Glyphosate	µg/L	P	-	700 (as)	-	700 (as)	700	-	-
Hexachlorocyclopentadiene	µg/L	P	-	50/8(f,as)	-	50(as)	-	-	-
Lindane (gamma-BHC)	µg/L	P	0.2	-	0.2	-	4	-	-
Methoxychlor	µg/L	P	40	-	40	-	100	-	-
Pentachlorophenol	µg/L	P	1	-	-	*200*	-	future review	30
Phthalates (Di(2-ethylhexyl)phthalate)	µg/L	P	-	4 (as)	-	0 (as)	4	-	-
Picloram	µg/L	P	-	500 (as)	-	500 (as)	-	-	-
Polychlorinated biphenyls (PCBs)	-	-	-	-	-	-	-	-	-
PCB Arochlor 1016	µg/L	P	0.5	-	0	-	-	-	-
PCB Arochlor 1221	µg/L	P	0.5	-	0	-	-	-	-
PCB Arochlor 1232	µg/L	P	0.5	-	0	-	-	-	-
PCB Arochlor 1242	µg/L	P	0.5	-	0	-	-	-	-
PCB Arochlor 1248	µg/L	P	0.5	-	0	-	-	-	-
PCB Arochlor 1254	µg/L	P	0.5	-	0	-	-	-	-
PCB Arochlor 1260	µg/L	P	0.5	-	0	-	-	-	-
Polynuclear Aromatic Hydrocarbons (PAHs)	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	µg/L	P	-	0.2	-	0 (as)	-	-	-
Benz(a)anthracene	µg/L	P	-	0.1	-	0 (as)	-	-	-
Benzo(b)fluoranthene	µg/L	P	-	0.2	-	0 (as)	-	-	-
Benzo(k)fluoranthene	µg/L	P	-	0.2	-	0 (as)	-	-	-
Chrysene	µg/L	P	-	0.2	-	0 (as)	-	-	-
Dibenz(a,h)anthracene	µg/L	P	-	0.3	-	0 (as)	-	-	-
Indenopyrene	µg/L	P	-	0.4	-	0 (as)	-	-	-
Simazine	µg/L	P	-	1 (as)	-	1 (as)	10	-	-
2,3,7,8-TCDD (Dioxin)	µg/L	P	-	0.00005 (as)	-	0(as)	-	-	-
Toluene	µg/L	P	1,000	2,000/40(f)	1,000	2,000	MNTR-A	internal review	100
Toxaphene	µg/L	P	3	5	0	-	5	-	-
2,4,5-TP (Silvex)	µg/L	P	50	-	50	-	10	-	-
1,1,2-Trichloroethane	µg/L	P	-	5 (as)	-	3 (as)	32	-	-
Vydate (oxamyl)	µg/L	P	-	200 (as)	-	200 (as)	-	-	-
Xylene	µg/L	P	10000 (al)	-/20(f)	10000 (al)	-	1,750(al)	-	-

TABLE 1-1
WATER QUALITY STANDARDS FOR DRINKING WATER
(current as of January 1993)
(continued)

PARAMETER	UNIT	P/S(a)	U.S. Environmental Protection Agency MCL Existing	MCL Proposed	MCLG Existing	MCLG Proposed	California Department of Health Services MCL	MCL Proposed	Action Levels
Unregulated SOCs									
Bromobenzene	-	-	-	(ak)	-	-	MNTR-A	-	-
Bromochloromethane	-	-	-	(ak)	-	-	MNTR-B	-	-
Bromomethane	-	-	-	(ak)	-	-	MNTR-A	-	-
n-Butylbenzene	-	-	-	(ak)	-	-	MNTR-B	-	-
sec-Butylbenzene	-	-	-	(ak)	-	-	MNTR-B	-	-
tert-Butylbenzene	-	-	-	(ak)	-	-	MNTR-B	-	-
Chloroethane	-	-	-	(ak)	-	-	MNTR-A	-	-
Chloromethane	µg/L	P	-	(ak)	-	-	MNTR-A	-	-
o-Chlorotoluene	-	-	-	(ak)	-	-	MNTR-A	-	-
p-Chlorotoluene	-	-	-	(ak)	-	-	MNTR-A	-	-
DDD	-	-	-	(ak)	-	-	-	-	-
DDE	-	-	-	(ak)	-	-	-	-	-
DDT	-	-	-	(ak)	-	-	-	-	-
Dichlorodifluoromethane (Freon 12)	µg/L	P	-	(ak)	-	-	MNTR-A	-	-
1,1-Dichloroethane	µg/L	P	-	(ak)	-	-	5	-	-
1,3-Dichloropropane	-	-	-	(ak)	-	-	MNTR-A	-	-
2,2-Dichloropropane	-	-	-	(ak)	-	-	MNTR-A	-	-
1,1-Dichloropropene	-	-	-	(ak)	-	-	MNTR-A	-	-
1,3-Dichloropropene	µg/L	P	-	(ak)	-	-	0.5	-	-
Endrin Aldehyde	-	-	-	(ak)	-	-	-	-	-
Endosulfan I	-	-	-	(ak)	-	-	-	-	-
Endosulfan II	-	-	-	(ak)	-	-	-	-	-
Endosulfan Sulfate	-	-	-	(ak)	-	-	-	-	-
Ethylbenzene	µg/L	P	700	-/30(f)	700	-	680	-	-
Heptachlor	µg/L	P	0.4	-	0	-	0.01	-	-
Heptachlor Epoxide	µg/L	P	0.2	-	0	-	0.01	-	-
Hexachlorobenzene	µg/L	P	-	1 (as)	-	0 (as)	-	-	-
Hexachlorobutadiene	-	-	-	(ak)	-	-	MNTR-B	-	-
Isopropylbenzene	-	-	-	(ak)	-	-	MNTR-B	-	-
p-Isopropyltoluene	-	-	-	(ak)	-	-	MNTR-B	-	-
Londax	-	-	-	(ak)	-	-	-	-	-
Naphthalene	-	-	-	(ak)	-	-	MNTR-B	-	-
Propanol	-	-	-	(ak)	-	-	-	-	-
n-Propylbenzene	-	-	-	(ak)	-	-	MNTR-B	-	-
Styrene	µg/L	P	100	5/10(f)	100	0	MNTR-A	-	-
1,1,1,2-Tetrachloroethane	-	-	-	(ak)	-	-	MNTR-A	-	-
1,1,2,2-Tetrachloroethane	µg/L	P	-	(ak)	-	-	1	-	-
1,2,4-Trimethylbenzene	-	-	-	(ak)	-	-	MNTR-B	-	-
1,3,5-Trimethylbenzene	-	-	-	(ak)	-	-	MNTR-B	-	-
1,2,3-Trichloropropane	-	-	-	(ak)	-	-	MNTR-A	-	-
EPA Method 507 Compounds	-	-	-	(ak)	-	-	-	-	-
EPA Method 508 Compounds	-	-	-	(ak)	-	-	-	-	-

TABLE 1-1

WATER QUALITY STANDARDS FOR DRINKING WATER

(current as of January 1993)

(continued)

PARAMETER	UNIT	P/S(a)	U.S. Environmental Protection Agency MCL Existing	MCL Proposed	MCLG Existing	MCLG Proposed	California Department of Health Services MCL	MCL Proposed	Action Levels
State Action Levels									
Aldrin	µg/L	P	-	-	-	-	-	(am)	0.05
Baygon	µg/L	P	-	-	-	-	-	(am)	90
Bentazon (Basagran)	µg/L	P	-	-	-	-	18	-	-
alpha-BHC	µg/L	P	-	-	-	-	-	(am)	0.7
beta-BHC	µg/L	P	-	-	-	-	-	(am)	0.3
Bolero (Thiobencarb)	µg/L	P	-	-	-	-	70/1 (f)	-	-
Bromacil (Hyvar X, Hyvar XL)	-	-	-	-	-	-	MNTR-B	-	-
Captan	µg/L	P	-	-	-	-	-	(am)	350
Carbaryl	µg/L	P	-	-	-	-	-	(am)	60
CIPC (an)	µg/L	P	-	-	-	-	-	(am)	350
Diazinon	µg/L	P	-	-	-	-	MNTR-B	(am)	14
Dieldrin	µg/L	P	-	-	-	-	-	(am)	0.05
Dimethoate	µg/L	P	-	-	-	-	MNTR-B	(am)	140
2,4-Dimethylphenol	µg/L	S	-	-	-	-	-	(am)	400
Diphenamide	µg/L	P	-	-	-	-	-	(am)	40
Ethion	µg/L	P	-	-	-	-	-	(am)	35
Formaldehyde	µg/L	P	-	-	-	-	-	(am)	30
Malathion	µg/L	P	-	-	-	-	-	(am)	160
Methyl Parathion	µg/L	P	-	-	-	-	-	(am)	30
Molinate (Ordram)	µg/L	P	-	-	-	-	20	-	-
Parathion	µg/L	P	-	-	-	-	-	(am)	30
Pentachloronitrobenzene	µg/L	P	-	-	-	-	-	(am)	0.9
Phenol	µg/L	S	-	-	-	-	-	(am)	5(ao)
Trichlorofluoromethane (Freon 11)	µg/L	P	-	(ak)	-	-	150	Internal review	-
Trichlorotrifluoroethane (Freon 113)	µg/L	P	-	-	-	-	1,200	Internal review	-
Trithion	µg/L	P	-	-	-	-	-	(am)	7

TABLE 1-1
WATER QUALITY STANDARDS FOR DRINKING WATER
(current as of January 1993)
(continued)

PARAMETER	UNIT	P/S(a)	U.S. Environmental Protection Agency MCL Existing	MCL Proposed	MCLG Existing	MCLG Proposed	California Department of Health Services MCL	MCL Proposed	Action Levels
DISINFECTANTS AND DISINFECTION BY-PRODUCTS									
Disinfectant Residuals									
Chloramine	-	-	(o)	(v)	-	-	-	-	-
Chlorate	-	-	-	(v)	-	-	-	-	-
Chlorine	-	-	(o)	(v)	-	-	-	-	-
Chlorine dioxide	-	-	-	(v)	-	-	-	-	-
Chlorite	-	-	-	(v)	-	-	-	-	-
Hypochlorite ion	-	-	-	(v)	-	-	-	-	-
Ozone	-	-	-	(v)	-	-	-	-	-
Trihalomethanes									
Bromodichloromethane	-	-	-	(v)	-	-	MNTR-A	-	-
Bromoform	-	-	-	(v)	-	-	MNTR-A	-	-
Chloroform	-	-	-	(v)	-	-	MNTR-A	future review	-
Dibromochloromethane	-	-	-	(v)	-	-	MNTR-A	future review	-
Dichloroiodomethane	-	-	-	(v)	-	-	-	-	-
Haloacetic Acids									
Dichloroacetic acid	-	-	-	(v)	-	-	-	-	-
Monochloroacetic acid	-	-	-	(v)	-	-	-	-	-
Trichloroacetic acid	-	-	-	(v)	-	-	-	-	-
Other haloacetic acids	-	-	-	(v)	-	-	-	-	-
Haloacetonitriles									
Bromochloroacetonitrile	-	-	-	(v)	-	-	-	-	-
Dibromoacetonitrile	-	-	-	(v)	-	-	-	-	-
Dichloroacetonitrile	-	-	-	(v)	-	-	-	-	-
Other haloacetonitriles	-	-	-	(v)	-	-	-	-	-
Phenols									
2,4-Dichlorophenol	-	-	-	(v)	-	-	-	-	-
Other phenols	-	-	-	(v)	-	-	-	-	-
Other DBPs									
Alcohols	-	-	-	(v)	-	-	-	-	-
Aldehydes	-	-	-	(v)	-	-	-	-	-
Chloralhydrate	-	-	-	(v)	-	-	-	-	-
Chloropicrin	µg/L	P	-	(v)	-	-	-	-	50/37(f)
Cyanogen Chloride	-	-	-	(v)	-	-	-	-	-
Ketones	-	-	-	(v)	-	-	-	-	-
MX (aq)	-	-	-	(v)	-	-	-	-	-

TABLE 1-1
WATER QUALITY STANDARDS FOR DRINKING WATER
(current as of January 1993)
(continued)

			U.S. Environmental Protection Agency				California Department of Health Services		
PARAMETER	UNIT	P/S(a)	MCL Existing *	MCL Proposed	MCLG Existing	MCLG Proposed	MCL	MCL Proposed	Action Levels
OTHER									
Acid/Alum Balance	-	-	-	-	-	-	-	-	-
Acid Insoluble	-	-	-	-	-	-	-	-	-
Charge Density	-	-	-	-	-	-	-	-	-
Coupon Testing	-	-	-	-	-	-	-	-	-
Crystalline Structure	-	-	-	-	-	-	-	-	-
Disinfection Demand Test	-	-	-	-	-	-	-	-	-
Filter Media Algae Test	-	-	-	-	-	-	-	-	-
Filter Media Disinf. Demand	-	-	-	-	-	-	-	-	-
HazCat	-	-	-	-	-	-	-	-	-
Jar Tests	-	-	-	-	-	-	-	-	-
KMnO4 Demand Test	-	-	-	-	-	-	-	-	-
Lime Slaking	-	-	-	-	-	-	-	-	-
Oil and Grease	-	-	-	-	-	-	-	-	-
PAC Demand Test	-	-	-	-	-	-	-	-	-
Percent Solids	-	-	-	-	-	-	-	-	-
Sieve Analysis	-	-	-	-	-	-	-	-	-
Specific Gravity	-	-	-	-	-	-	-	-	-
Tank Coating Solvents	-	-	-	-	-	-	-	-	-

TABLE 1-1
WATER QUALITY STANDARDS FOR DRINKING WATER
(continued)

(a) Identifies the standard as primary (P) or secondary (S). The EPA secondary standards are recommended, but not enforceable. The DOHS secondary standards are enforceable unless otherwise stated.
(b) Monitoring required only if continuous or persistent deterioration of the parameter exists.
(c) Recommended MCL.
(d) Regulations developed after SDWA Amendments of 1986.
(e) SWTR specifies filtration and disinfection as the treatment technique for this contaminant.
(f) The latter value is a secondary MCL (a recommended, but not an enforceable, standard).
(g) (Footnote no longer applies.)
(h) Average annual dose from beta particle and photon radioactivity not to exceed 4 millirem/yr.
(i) Equivalent to 20 μg/L.
(j) Total coliform positives must be checked for fecal coliforms or E. coli.
(k) Expected to be similar to EPA MCL but has not yet been formally proposed.
(l) The recommended density at entrance to the distribution system is <10 CFU/ml and throughout the distribution system is <500 CFU/ml.
(m) Units dependent upon analytical technique (MF - org/100 ml; MPN - MPN/100 ml; Colilert™ - present/absent).
(n) Effective Dec. 31, 1990
(o) Final SWTR includes a requirement for a 0.2 mg/L minimum residual at the entrance-point to the distribution system. Residual must be monitored continuously. Residuals must be detectable in 95% of samples.
(p) For a system serving a population of 220,001 to 320,000, minimum number of total coliform samples is 160 per month. If the population is 600,001 to 780,000, minimum number of total coliform samples is 240 per month.
(q) For a public water system which collects at least 40 samples per month.
(r) (Footnote no longer applies.)
(s) For a community water system with 52,101 to 59,200 service connections, minimum number of bacteriological samples is 36 per week.
(t) A parameter deleted from the original list of 83 contaminants (identified in 47 FR 9352 and 48 FR 45502) and placed on the DWPL for regulation at a later date.
(u) No other numbers are under consideration at this time. MCL may change in two years or more depending on future studies.
(v) This parameter has been targeted by EPA for potential regulation.
(w) Required for vulnerable systems. Frequency: State's discretion.
(x) Refers to fibers >10μm in length.
(y) (Footnote no longer applies.)
(z) Action level. Triggers treatment technique requirements.
(aa) MCL Proposed for Total Nitrate and Nitrite = 10 mg/L (as N).
(ab) AOC is anticipated to be controlled through development of a treatment technique for the regulation of disinfectants and DBPs.
(ac) Under evaluation. MCL is anticipated to be 20 to 50 μg/L based on comments by EPA staff.
(ad) (Footnote no longer applies.)
(ae) This parameter has been targeted by EPA for regulation.
(af) For sum of o-, m-, and p- isomers.
(ag) Discretionary. Frequency: State's discretion.
(ah) Maximum acceptable level of acrylamide in polyacrylamide is 0.05 percent by weight; the use level as a flocculant is 1 ppm.
(ai) Monitoring not specified. Manufacturer and dosage certification required annually.
(aj) (Footnote no longer applies.)
(ak) This parameter has been targeted by EPA for potential regulation. Whether or not an MCL will be developed depends on the results of ongoing monitoring programs.
(al) Interim Action Level.
(am) This parameter may potentially be regulated.
(an) Isopropyl-N-(3-chlorophenyl)carbamate
(ao) For chlorinated systems.
(ap) Ct Product requirements established. Also, a residual sample is required corresponding to each total coliform sample.
(aq) 3-Chloro-4-(dichloromethyl)-5-hydroxy-2(5H)-furanone
(ar) EPA recommends 20 mg/L for persons on severely restricted diets. See Quality Criteria for Water, USEPA, 1976.
(as) Proposed July 25, 1990. BAT also proposed.
(at) Two options proposed July 25, 1990. BAT also proposed.

ABBREVIATIONS

1/3Y - 1 every 3 years
Q/4Y - Quarterly for 1 year, every 4 years
BAT - Best Available Technology
D - Daily
DWPL - Drinking Water Priority List
M - Month
MCLG - Maximum Contaminant Level Goal
Q - Quarterly
SOC - Synthetic Organic Compound
VOC - Volatile Organic Compound
W - Week
Y - Yearly
CFU - Colony Forming Units
DOHS - Dept. of Health Services
FR - Federal Register
MFL - Million Fibers per Liter
SDWA - Safe Drinking Water Act
SWTR - Surface Water Treatment Rule
pCi/L - PicoCuries per Liter
ppm - Parts per Million
EPA - Environmental Protection Agency
org - Organism
Ct - Residual Concentration (mg/L) * Contact Time (min)
MF - Membrane Filtration
MPN - Most Probable Number
MCL - Maximum Contaminant Level
P - Primary Standard
S - Secondary Standard
AL - Action Level
MNTR-A - Monitoring required for all community and non-transient, non-community water systems.
MNTR-B - Monitoring required for all community and non-transient, non-community water systems if determined vulnerable

APPENDIX D

FERTILIZER AND PESTICIDE USAGE AND HARDING PARK GOLF COURSE

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JAN 29 1990
Environmental Science Assoc

January 29, 1990
[Project 90-1124]

Ms. Marilyn Duffey
The Duffey Company
1172 Greenwich Street
San Francisco, California 94109

Subject: Potential Impact of Harding Park Golf Courses
on Lake Merced Water Quality
San Francisco, California

Dear Ms. Duffey:

As authorized, McCulley, Frick & Gilman, Inc. (MFG) is pleased to submit this letter report concerning potential impacts on Lake Merced water quality resulting from fertilizer and pesticide use at the Harding Park golf courses. Two golf courses, Harding Park Golf Course and Fleming Golf Course, occupy Harding Park. Harding Park is located east of and partly adjacent to Lake Merced in the southwestern part of the City and County of San Francisco. Fertilizers and pesticides are applied to the greens, tees and fairways of the golf courses.

The scope of our investigation was to: review information you provided on fertilizer and pesticide use at the golf courses; obtain additional data on the fertilizers and pesticides used, including active ingredients, toxicity and the properties important to their fate and transport in soil and water; conduct a site visit; and prepare a report.

CHEMICAL USE

Chemicals used for turf management on the Harding Park golf courses include fertilizers and pesticides. You transmitted to MFG a list of chemicals used in 1989, which had been compiled by the San Francisco Recreation and Park Department. During our site visit discussed below, the use of several other chemicals both in 1989 and historically was reported by Recreation and Park Department staff.

Most fertilizers used on the golf courses are high in nitrate, with smaller proportions of phosphate and potash. However, some fertilizers are also high in potash. The fertilizers used in greatest quantity in 1989 are "Mini-Pellets" (16-4-8) on the greens and "Par Ex" (21-4-21) on the fairways. Fertilizers generally are soluble, non-toxic compounds. Potential water quality impacts

could result from fertilizer use because of the following processes:

- Nitrate (NO_3) is a soluble ion that can be leached from soils into underlying ground water by percolating rainfall and irrigation water. Nitrate in drinking water has been known to cause infant methemoglobinemia (blue baby syndrome); a maximum contaminant level of 10 milligrams per liter (mg/L) as nitrogen (N) has been established as a primary drinking water standard for nitrate (US EPA).
- Nitrogen (found in nitrate ion) and phosphorous (in phosphate ion) are nutrients responsible for promoting algae growth in surface water bodies. Both of these nutrients could enter Lake Merced from surface water runoff from the golf course. Assuming that the water table intersects Lake Merced at one or more locations, shallow ground water containing nitrate could also enter the lake via subsurface seepage. Phosphate is strongly sorbed to soil particles and is less likely to be leached into underlying ground water.

The particular pesticides applied to the Harding Park and Fleming Golf Courses in 1989 include herbicides, fungicides, a nematicide and a rodenticide. No use of insecticides was reported. Because the chemistry, toxicity and environmental behavior of pesticides are variable, MFG compiled in Table 1 the representative properties important to the fate and transport of those pesticides reportedly used in 1989 and historically. Table 1 lists the trade names, active ingredients, solubility in water, toxicity, soil adsorptivity and soil persistence for the pesticides. Information in this table was obtained from the Farm Chemicals Handbook '89 and from a recently published study of chemical use on golf courses in Cape Cod, Massachusetts (Cohen, et al., 1990). Information on some of the parameters was not available for some pesticides used at the golf courses.

Table 1 is organized with the more water soluble, toxic and persistent and/or less sorbing pesticides listed near the top. Of the pesticides used at the golf courses, the ones judged to have the highest potential to cause water quality impacts on Lake Merced are Nemacure, Trimec and Banvel. Nemacure is soluble and is highly toxic based on its rat oral LD_{50}. Because the adsorptive and persistent properties of nemacure were not available, it is considered to have the potential to cause water quality impacts. Trimec and Banvel contain salts of dicamba and/or dichlorobenzoic acid, which are highly mobile and of medium and high persistence,.

respectively. Cohen, et al. (1990) found mainly 2,4-dichlorobenzoic acid with scattered detections of dicamba, 2,4-D and other compounds in ground water beneath the golf courses studied on Cape Cod. In that Cape Cod study, the concentrations of detected compounds were relatively low. Bromoxynil was the herbicide used in greatest abundance in 1989. Bromoxynil is toxic to fish. Fore (mancozeb) was the fungicide used in greatest abundance in 1989 followed in abundance by Cleary 3336 (thiophanate). Both of these fungicides are in toxicity Class III (relatively low) are practically insoluble in water (Table 1).

SITE VISIT

Thomas Ervin of MFG conducted a site visit on January 17, 1990 with Robert Killian, Golf Program Director, and Roul Hernandez, Park Section Supervisor, both with the San Francisco Recreation and Park Department. Mr. Hernandez is responsible for the Harding Park and Fleming Golf Courses and Lake Merced. The purpose of the site visit was to: (1) observe the portion of the golf course perimeter that borders Lake Merced; (2) observe pesticide and fertilizer storage areas and the pesticide mixing area; and (3) interview golf course staff members regarding the use of fertilizers and pesticides.

Holes 10 through 18 (back nine) of the Harding Park Golf Course border Lake Merced. The Fleming Golf Course does not abut the lake and, therefore, was not observed in detail. The golf courses are separated from Lake Merced by a steep slope immediately adjacent to the lake and a wooded zone between the slope and the golf course, except near the 18th tee of the Harding Park Golf Course. The width of this wooded zone is generally 10 to 20 feet from the fairway side of the drip line of the trees to the edge of the steep slope. Near the 18th tee, a grassy area is present along the edge of a marsh adjacent to Lake Merced.

Trees and broadleaf herbaceous vegetation at the edge of the golf course appeared healthy at the time of the site visit. Waterfowl observed on Lake Merced included coots, egrets and a cormorant. Mr. Hernandez reported that trout are stocked in the lake. He stated that fish have been less abundant in recent years, which he attributes to lower than normal water levels in the lake. Mr. Hernandez stated that algal blooms occur from time to time in the lake. Algae were not apparent during the site visit.

Pesticide and Fertilizer Storage. Pesticides are stored in locked wooden cabinets located in a shed with a wooden floor. The shed is located in the center of the Harding Park Golf Course near the 9th tee, approximately 175 yards from the lake shore. There is an approximately three-foot high crawl space under the shed. Mr. Killian reported that storage will be improved next month when a storage container with a concrete slab floor will be installed.

Mr. Killian stated that pesticides are purchased shortly before application. The locked cabinets were opened by Mr. Hernandez revealing stock on hand, which consisted of two to five containers of several pesticides.

Approximately 50 bags each of two different fertilizers were present in another shed adjacent to the pesticide storage shed. Both types of fertilizers were high in nitrate.

Pesticide Use. Pesticides are mixed in an outdoor area near the storage shed. A water faucet is located in the mixing area. No provisions were evident for containing spilled chemicals. The mixing area was muddy at the time of the site visit. Other muddy areas were not observed during the site visit.

Mr. Killian stated that fairways are sprayed with herbicides twice a year, in February before the City golf tournament and in the fall. According to information submitted to MFG, herbicides currently sprayed on the fairways include Trimec, Banvel and Roundup. Bromoxynil (an herbicide) also has been used, including applications in 1989; however, the Recreation and Park Department does not plan to use Bromoxynil in the future. Roundup is used only in small quantities on a spot basis. The primary target of herbicide use is a type of small daisy, according to Mr. Killian.

Mr. Killian stated that greens are sprayed with fungicides once per month. Many different fungicides are used to avoid resistance and because species of fungi vary from time to time and by location.

Mr. Killian and Mr. Hernandez described the following practices for applying pesticides on the golf courses. Pesticide application equipment consists of a backpack tank with spray nozzle, a tank with spray arms that is mounted on the back of a Cushman vehicle, a trailer with tank and spray arms which is towed behind a tractor, and two hand sprayers. With the vehicle/trailer-mounted equipment, the spray extends approximately six inches beyond the end of the spray arms. The pesticide spray is applied

to dry vegetation. Spraying is done during evenings, at night and in the early morning when the public is not present. Spraying the fairways generally requires four nights, and spraying the greens requires one to two nights. Spraying is not done during windy conditions. The public is excluded from the area sprayed until the grass is dry (generally at least 12 hours). Following pesticide application, sprayed areas are not watered for four to five days afterward. Herbicides are not applied closer to Lake Merced than the drip line of the trees (approximately 10 to 20 feet); however, herbicides are sprayed along the edge of the marsh near the 18th tee, which is adjacent to the lake.

Application of the following chemicals used at the golf courses is restricted by the United States Environmental Protection Agency: 2,4-D; Banvel; Zinc Phosphide; and Nemacur (Table 1). Notification of the County Department of Agriculture is required at least twenty-four hours prior to use of these restricted chemicals. The Department of Agriculture has the option of sending an inspector to supervise application of the restricted chemicals.

Mr. Killian stated that the use, storage and disposal of pesticides are supervised by the San Francisco County Department of Agriculture. In a telephone conversation between MFG and Sharon Aby, Agricultural Inspector with the San Francisco County Department of Agriculture, Ms. Aby stated that no problems in the use or storage of pesticides had been found during her agency's inspections of the golf courses. Ms. Aby also stated that all pesticide applicators at the golf courses are properly trained in the application of pesticides. The chief spray applicator, Bill Del Carlo, confirmed during our site visit that he is properly certified and trained as a pesticide applicator.

Pesticide Disposal. According to Mr. Del Carlo, empty pesticide containers are triple rinsed and then sent to a Class I (hazardous waste) landfill for disposal. Mr. Del Carlo stated that the rinsate is sprayed on the fairways in the same manner as the chemicals. Mr. Hernandez stated that empty pesticide containers are temporarily stored in a locked wooden cabinet at the pesticide storage shed prior to shipment to a Class I landfill. He unlocked the cabinet revealing several plastic garbage bags filled with these empty containers.

EVALUATION

Overall, the golf courses and the fertilizer and pesticide application program appeared to be well managed. No obvious chemical contamination was observed during the site visit. However, the chemicals used at the golf courses have the potential to impact Lake Merced and the shallow ground water underlying the golf courses because of their soluble and/or toxic nature.

Based on this study, MFG has identified the four most likely locations and processes with the potential to cause water quality impacts: (1) leakage through the wooden floor of the pesticide storage area; (2) migration of chemicals from the pesticide mixing area; (3) migration of herbicides sprayed at the edge of the marsh near the 18th tee; and (4) migration of nitrates from the use of fertilizers. Construction of the new pesticide storage container on a concrete pad will improve conditions for storing pesticides at the golf courses.

The potential to cause water quality impacts is mainly dependent on two factors: (1) transport pathways; and (2) chemical properties that allow transport to occur.

First, a plausible pathway must exist for chemicals to be transported to Lake Merced. The golf courses are underlain by sandy soil that has been derived from dune sand deposits. Nitrate and soluble pesticides with low sorption potential can rapidly leach through this sandy soil to the underlying ground water. The shallow ground water is assumed to flow toward Lake Merced and enter the lake via subsurface seepage. Chemicals can also be transported into the lake (either in dissolved or suspended form) in runoff from rainfall or excess irrigation. These pathways of chemical transport to Lake Merced also might exist from two private golf courses located near the lake and from storm water runoff entering the lake from outside Harding Park. Without intensive monitoring of water quality conditions, it would be difficult to separate the contribution from each of the potential sources.

Second, the potential for chemicals to be transported into Lake Merced and/or the shallow ground water underlying the golf courses depends on the properties of the particular chemicals. Nitrate in fertilizers used on the golf courses is a soluble and persistent constituent. Cohen, et al. (1990) found that the average nitrate concentrations in ground water beneath golf courses on Cape Cod ranged from about 1 to 7 milligrams per liter (mg/l), with a maximum of 30 mg/l. The nitrate concentrations in ground water also appeared to be influenced by management practices; slow-

release nitrogen fertilizers and lower application rates resulted in lower nitrate concentrations in ground water. The golf courses evaluated by Cohen et al. (1990) also were underlain by sandy sediments. Some of the pesticides used on the golf courses are also soluble, weakly adsorbed to soil particles and moderately persistent (Table 1), including Trimec, Banvel and Nemacur.

RECOMMENDATIONS

Recommendations for various activities, including the collection and analysis of water samples, are presented below to supplement the present study. The scope of the recommended work is intended to verify our assessment of the factors related to water-quality impacts, which were discussed in the above section entitled, "EVALUATION." The discussion of ground-water and surface-water monitoring in the following subsections is general, because the design of a monitoring program was beyond the scope of the present study. However, we recommend that such a monitoring program be designed and specified in detail as part of the next phase of work.

Transport Pathways. The movement of shallow ground water into Lake Merced should be confirmed. To our knowledge, the nearest shallow wells are located at the Oceanside Water Pollution Control Plant property, west of Lake Merced. Additional monitoring wells should be installed at the Harding Park and Fleming Golf Courses, so that the direction of ground-water movement can be evaluated. These wells also will permit the elevations of the water table and the lake bottom to be compared.

The potential for surface water runoff from the golf courses into Lake Merced should be directly observed. Site visits should be conducted during two conditions: (1) a rainstorm of above-average intensity; and (2) average irrigation of the golf courses. During these site visits, overland or channelized flow into Lake Merced should be documented. Runoff conditions in the vicinity of the marsh near the 18th tee at the Harding Park Golf Course should be particularly evaluated.

Chemical Properties. Additional published data on the toxicity, mobility and persistence of the specific pesticide compounds used at the golf courses should be obtained, if available. Commercial chemical analysis methods should be evaluated to identify the pesticide test methods applicable to the more mobile compounds.

Staff of the Recreation and Park Department should periodically review alternatives to the chemicals used to ensure use of the least toxic, least persistent, least mobile and most selective products available. Timed-release fertilizers are an alternative that will decrease the potential for elevated nitrate concentrations to be transported to shallow ground water and, in turn, to Lake Merced.

Chemical Concentrations. Water samples should be collected from Lake Merced and analyzed for nitrate and for constituents of the more mobile and persistent pesticides used at the golf courses. Based on the present study, the minimum analytical testing should include nitrate, dicamba and dichlorobenzoic acid (2,4-D, although reportedly not persistent, may be analyzed using the same test method as dicamba). These constituents for which samples will be analyzed should be reevaluated after the recommendations presented in the subsection "Chemical Properties" have been implemented.

Ground-water monitoring wells should be installed near the pesticide and fertilizer storage areas, the pesticide mixing area, and the 18th tee (in vicinity of marsh) at the Harding Park Golf Course to evaluate the shallow ground-water quality at these locations. The proposed monitoring wells may include wells used to evaluate ground-water movement and recommended in the subsection "Transport Pathways." The protocol for chemical analysis of ground-water samples should follow that for the Lake Merced water samples.

Mass balance calculations for nitrate should be performed to estimate the nitrate concentrations in shallow ground water, based on irrigation and fertilizer application rates. The calculated nitrate concentrations should be compared to the observed nitrate concentrations in ground-water samples from the monitoring wells.

REFERENCES

Cohen, S. Z., Nickerson, S., Maxey, R., Dupuy, A., Jr., and Senita, J. A., 1990, A ground water monitoring study for pesticides and nitrates associated with golf courses on Cape Cod: Ground Water Monitoring Review, v. 10, n. 1, Winter 1990, p. 160 - 173.

Farm Chemicals Handbook '89, 1989: (Willoughby, Ohio, Meister Publishing Company).

United States Environmental Protection Agency (US EPA), 1979, National primary drinking water standards, maximum contaminant levels: Title 40, Code of Federal Regulations, Part 141.11.

Please contact me if we can be of further assistance or if you have any questions concerning this report.

Sincerely yours,

McCULLEY, FRICK & GILMAN, INC.

Jeffrey A. Gilman

Jeffrey A. Gilman, C.E.G.
Principal Hydrogeologist

lkmerced.ltr

TABLE 1

DATA FOR PESTICIDES USED AT THE HARDING PARK[1] AND FLEMING GOLF COURSES

Pesticide	Active Ingredients	Solubility	Toxicity	Soil Adsorption[2]	Soil Persistence[3]
Nemacur (Fenamiphos) systemic nematicide	Ethyl 3-methyl-4-(methylthio) phenyl (1- methylethyl) phosphoramidate	400 ppm	Class I[4], Rat Oral LD_{50} = 5 mg/kg	NA[5]	NA
Calo-Clor[6] fungicide	60% Mercurous chloride 30% Mercuric chloride	Wettable powder	Class I, Rat Oral LD_{50} = 55.2 mg/kg	NA	NA
Trimec herbicide	Dimethylamine salts of 2,4-D (31%), mecoprop (16%) dicamba (3%)	Soluble in water	Class I, Rat Oral LD_{50} = 2380 mg/kg	Moderate for 2,4-D Low for dicamba	Low for 2,4-D (1/4 mo.) Medium for dicamba (1 to 1-1/2 months)
Banvel (Dicamba) herbicide	Dimethylamine salt of 2-methoxy-3,6- dichloro-benzoic acid or dimethyl-amine salt of 3,6 -dichloro-o-anisic acid (Dicamba)	4500 ppm in water; Dicamba is soluble in water	Class II, Rat Oral LD_{50} = 2629 mg/kg Fish-non toxic Rainbow trout LC_{50}= 35 mg/l, Bluegill 40 mg/l, Carp 465 mg/l	Low	Medium (1 to 1-1/2 months)
Roundup (Glyphosate) herbicide	Isopropylamine salt of N-(Phosphono-methyl) glycine	Soluble	Class II, Rat Oral LD_{50}= 4900 mg/kg	Very strong	Medium (1 month)
Bromoxynil selective herbicide	3, 5- Dibromo-4-hydroxy-benzonitrile	Insoluble in water	Class II, Rat Oral LD_{50}= 260 mg/kg Fish toxic Rainbow trout LC_{50}= 0.05 mg/l	NA	NA
Subdue 2E (Metalaxyl) fungicide	N-(2,6- Dimethylphenyl) -N- (methoxyacetyl) - alanine methyl ester	7100 ppm in water	Class I, Rat Oral LD_{50}= 669 mg/kg	NA	NA
Tersan 1991 (Benomyl) systemic fungicide	Methyl 1-(butylcarbamoyl)-2- benzini-dazolecarbamate	Practically insoluble in water	Class III, Rat Oral LD_{50} > 10,000 mg/kg Fish - slightly toxic	NA	NA

TABLE 1 (Continued)

DATA FOR PESTICIDES USED AT THE HARDING PARK
AND FLEMING GOLF COURSES

Pesticide	Active Ingredients	Solubility	Toxicity	Soil Adsorption	Soil Persistence
Chipco 26019 (Iprodione) contact fungicide	3- (3,5- dichlorophenyl) -N- (1-methylethyl) 2,4- dioxo -1- imidazolidine-carboxamide	Almost insoluble in water (13 mg/l)	Class III, Rat Oral LD_{50} > 10,000 mg/kg Fish-Rainbow trout LC_{50} (4 days) = 6.7 mg/l Bluegill 2.25 mg/l	NA	NA
Fore (Mancozeb) fungicide	Coordination product of zinc ion, manganese ethylene bisdithio-carbamate	Practically insoluble in water	Class III, Rat Oral LD_{50} = 11,200 mg/kg	NA	NA
Cleary 3336 (Thiophanate) systemic fungicide	Diethyl 4,4'-O-phenylenebis-(3-thioallophanate)	Nearly insoluble in water	Class III, Rat Oral LD_{50} = 15,000 mg/kg Daphnia LC_{50} = 24 mg/kg	NA	NA
Scotts Proturf (PCNB) fungicide	Pentachloronitrobenzene		Class III, Rat Oral LD_{50}=1700 mg/kg	NA	NA
Zinc phosphide rodenticide	Zinc phosphide	Insoluble	Class III, Rat Oral LD_{50}= 45.7 mg/kg	NA	NA

---

[1] References: Farm Chemicals Handbook '89 (Willoughby, Ohio: Meister Publishing Company) and Cohen, et al., 1990

[2] Soil adsorption is the relative tendency of the pesticide to be bound to soil particles (clay or organic matter) compared to dissolved in ground water.

[3] Soil Persistence is the relative tendency for the pesticide compound to resist chemical breakdown.

[4] Class I, II and III are U.S. Environmental Protection Agency toxicity classes that are indicators of human health hazards. Classes are based on the following health hazard indicators: oral LD_{50}, inhalation LD_{50}, eye effects and skin effects. The relative hazard decreases with increasing number (I, II, etc.).

[5] NA - Information not available.

[6] Discontinued; last used 15 years ago

APPENDIX E

VISTA GRANDE WATER QUALITY TESTING

KENNEDY/JENKS SAMPLING RESULTS - 1984

√ Jorge

Kennedy/Jenks Engineers

657 Howard Street
San Francisco California 94105
415-362-6065

4 May 1984

DEPT. OF PUBLIC WORKS
DALY CITY

MAY 9 1984
AM 7 8 9 10 11 12 1 2 3 4 5 6 PM

Mr. John C. Martin
Assistant City Manager
City of Daly City
90th & Sullivan Avenue
Daly City, CA 94105

Subject: Influence of Stormwater Runoff on Lake Merced
K/J 3195

Dear Mr. Martin:

This letter presents a summary of the analytical water quality and acute toxicity testing of Daly City stormwater which may be discharged to Lake Merced. These tests were performed as a result of the conclusions and recommendations of the October 1983 Preliminary Design Report for the Vista Grande Storm Sewer Project. Detailed descriptive information is presented in the attached memorandum dated 30 April 1984.

The findings presented in the attached memorandum are that, with the exception of coliform organisms, there appear to be no water quality parameters (pollutants) in the stormwater runoff which are in concentrations greater than those found in Lake Merced. Additionally, the rainbow trout utilized in our laboratory tests exhibited no toxic response to both non-diluted and diluted samples of the sampled stormwater runoff. The concentrations of coliform organisms in the runoff were found to be higher than the concentrations typically found in Lake Merced.

The results of these analyses are favorable, particularly when considering the sampled rainfall events were preceded by extended dry periods. The runoff conditions for which samples were obtained can be considered to be representative of "first flush" conditions and would probably contain pollutants in concentrations greater than would be experienced during average wet weather runoff conditions. These runoff conditions may also be an explanation for the higher coliform concentrations identified in the collected samples.

Although the scope of work for this study specified the sampling and testing of four separate rainfall events, only two such events were sampled and tested due to the drier than normal conditions for the period of January through April 1984. Even so, the results of the laboratory testing program strongly indicate that Daly City stormwater discharges to Lake Merced would not have a deleterious impact upon the lake's water quality.

EXTRA COPY

As such, we recommend that the City of Daly City initiate discussions with the City and County of San Francisco to determine the feasibility of regular stormwater discharge to Lake Merced. We believe these discussions should begin with Mr. Gene Kelleher, Manager of the San Francisco Water Department.

Kennedy/Jenks Engineers appreciates this opportunity to be of continued service to the City of Daly City, and we look forward to continuing to provide engineering services for this interesting project.

Very truly yours,

KENNEDY/JENKS ENGINEERS

Lyndel Melton

Lyndel W. Melton
Project Manager

LWM/san
Enclosures

✓ cc: Mr. Al Grote

Kennedy Jenks Engineers

Memorandum

7 May 1984

To: Lyndel Melton

From: Ronald M. Block, Ph.D.

Subject: Influence of Stormwater Runoff on Lake Merced
K/J 3195

INTRODUCTION

This study was conducted by Kennedy/Jenks Engineers Laboratory Division for the purpose of evaluating the potential influence of a direct discharge of stormwater runoff into Lake Merced. The objective of the study was to evaluate the effect on Lake Merced of stormwater which may be discharged during wet weather conditions. To achieve this objective, a comparison of water quality and acute toxicity to rainbow trout was determined on water sampled during wet weather flow conditions from the Vista Grande Canal and from the southern portion of Lake Merced adjacent to John Muir Drive.

From 1 January 1984 to 15 April 1984, significant amounts of rainfall (>0.3 inches) fell on only two days. These wet weather days were 13 February 1984 and 13 March 1984. Rainfall data for these days are included in Table 1. Two other attempts were made to collect stormwater samples from the Vista Grande Canal on 9 February and 16 April 1984. No samples were collected since the water level in Canal was low.

FIELD SAMPLING PROTOCOL

Water samples were collected from Lake Merced and the Vista Grande Canal at the two locations identified on Figure 1. Samples were collected between 1300 and 1330 on both 13 February and 13 March 1984. At each site, samples were collected as follows: Two five-gallon polyethylene containers (for bioassay), one half-gallon glass bottle (miscellaneous analyses), one one-liter glass bottle (for oil-and-grease analysis), and one 100-ml polyethylene bottle (for coliform analysis).

Each of the four sample containers was given a laboratory number and logged in the laboratory log book. Immediately after the samples were logged in, the total coliform and bioassay testing program was initiated.

BIOASSAY AND ANALYTICAL PROTOCOL

Chemical analysis of the stormwater runoff and Lake Merced water were conducted according to procedures described in "Guidelines Establishing Test Procedures for the Analysis of Pollutants" (Federal Register, Volume 44, December 3, 1979).

Bioassays on rainbow trout, Salmo gardneri, were conducted according to procedures described in "Standard Practices for Conducting Acute Toxicity Tests with Fishes, Macroinvertebrates, and Amphibians" (ASTM, 1980, E729-30).

The rainbow trout were purchased from Alex Fish Company, San Rafael, California where the fish were hatched and reared, and were certified disease-free. Fish were acclimatized to dechlorinated tap water at 15 ± 1°C for a period of at least one week prior to experimentation. Fish were fed commercial trout chow (Purina) during the acclimation period. Fish were not fed during the bioassays. A photo period of 16 hours light and 8 hours dark was maintained during the experiments.

Bioassay test tanks were 19 liter capacity measuring 25.5 cm depth x 41.5 cm length x 20.5 cm width. For each bioassay, each tank was filled with 10 liters of dilution water. Twelve tanks were used for each bioassay: two for control and five sets of two tanks for experimental concentrations.

Each bioassay tank was aerated. Dissolved oxygen, pH, and temperature of each tank was monitored daily during the 96-hour bioassays. Total alkalinity was measured at the initiation of each bioassay.

Ten fish were placed into each tank to begin the bioassay. The criterion of effect was death; defined as cessation of opercular movement. Test concentrations were based on a percentage of either Lake Merced water or stormwater runoff diluted with dechlorinated tap water.

RESULTS/DISCUSSION

Water quality data for samples collected on 13 February and 13 March 1984 are presented in Table 2. These water quality data

probably represent worst case values since the storm events were of relatively short duration and occurred after long dry spells. It was suspected that the stormwater sampled contained contaminants associated with an initial flush of the drainage area. With the exception of total coliform levels, the canal water is of a generally higher quality than the Lake Merced water.

The analytical data presented in Table 2 for both the lake and the canal do not reveal the presence of any substance in sufficient concentration to be toxic to fish. The total coliform levels are a result of the washing effect of the runoff water as it flows over the surface of the drainage area. The coliform levels would probably decrease substantially in the runoff following a longer duration storm than occurred on either sampling date. Coliforms do not represent a threat to aquatic biota and are susceptible to die-off from several natural phenomena (Lynch and Poole. 1979. Microbial Ecology. Halsted Press, New York. 266 pp.).

The results of the bioassays at the conclusion of a 96-hour exposure period for each sampling date are presented in Tables 3 and 4. These results indicate that the runoff water collected at the storm drain does not produce a lethal response to fish. No deaths were observed at any test concentration at the conclusion of the 96-hour test period for fish exposed to stormwater samples collected on either date. As shown in Table 3, all the fish in the 56% test concentration water were killed due to failure of the aerator. However, these deaths were the result of equipment failure and were not associated with any toxic characteristic of the runoff water.

CONCLUSIONS

A toxic response (i.e., death) was not observed in rainbow trout exposed to diluted and non-diluted concentrations of stormwater runoff being discharged to Lake Merced and to diluted and non-diluted concentrations of Lake Merced water following a 96-hour period of exposure.

An evaluation of potential pollutants in the stormwater runoff reveals lower levels of suspected pollutants than found in Lake Merced.

Although coliform organisms appear high in the stormwater, these results may be due to first flush conditions when the samples were collected in the field.

RMB/mm

APPENDIX

CATIONS OF SAMPLING STAT S

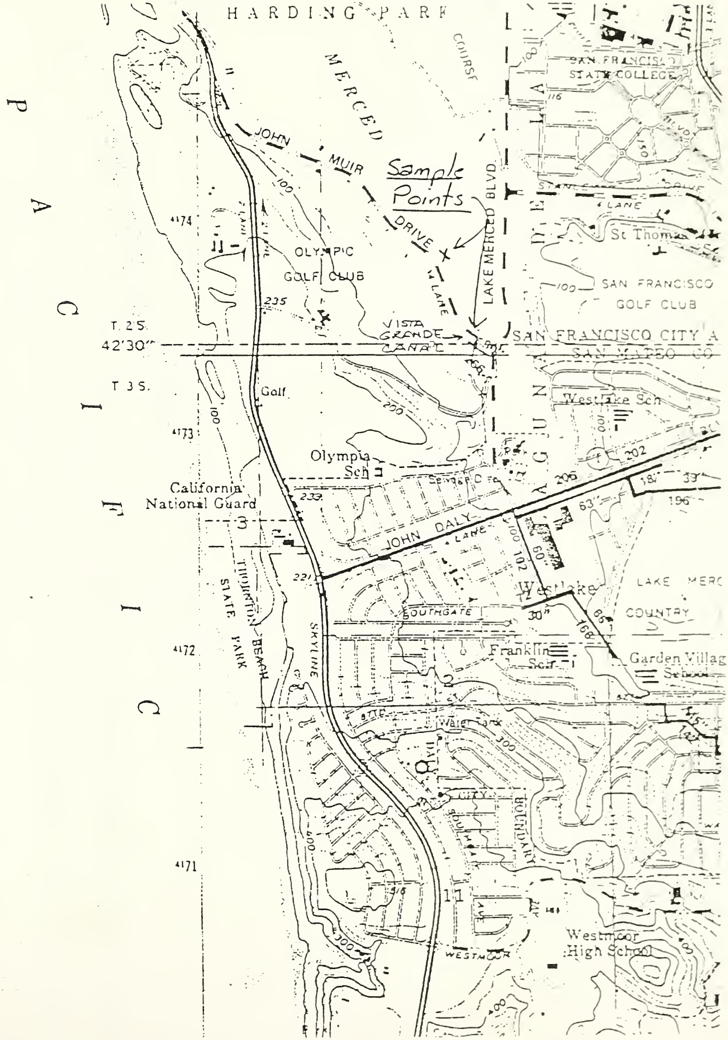

TABLE 1

UMMARY OF RAINFALL RECORDED AT SAN FRANCISCO INTERNATIONAL AIRPORT DURING STUDY PERIOD, INCHES[a]

Hour	DATE							
	2/8/84	2/9/84	2/10/84	2/11/84	2/12/84	2/13/84	3/12/84	3/13/84
-1		T[b]			T	T		T
-2					T	T	T	T
-3					T	T	T	
-4			.01		T	T	T	
-5		.01	T		T	T	T	T
-6		T				T	T	T
-7		T				T	T	
-8		.07				.01	T	.04
-9		T				T	T	.15
-10		T				.01		T
0-11		T		T		.19		.16
1-12				T		.25		.04
2-13				T		.04		.06
3-14		T		T	T	.04		.04
4-15				T	T	.01		T
5-16		.02		.02				
6-17		.02		.02				
7-18		.01		T		.02		.01
8-19		T						
9-20	T	.05						
0-21	T	T						
1-22	T	.04						
2-23	.02	T						.02
3-24	.02	T			T			

Previous significant storm: 0.33 inches/11 hours on 1/15/84.

T = trace rainfall < 0.01".

TABLE 2

SUMMARY OF WATER QUALITY DATA

Analysis	Units	13 February 1984		13 March 1984	
		Lake Merced	Vista Grande Canal	Lake Merced	Vista Grande Canal
pH (field)		7.5	6.7	8.1	7.3
Temperature	°C	13	15	16	16
Dissolved Oxygen (field)	mg/l	8.2	7.0	7.6	8.6
Total Alkalinity ($CaCO_3$)	mg/l	136	16	142	16
Conductivity @ 25°C	umohs/cm	449	48	515	64
Chloride (Cl)	mg/l	41	7.3	64	3.0
Turbidity	NTU	7.4	15	6.8	30
Sulfate (SO_4)	mg/l	16	3.7	4.0	14
Sodium (Na)	mg/l	37	3.5	11	4.9
Potassium (K)	mg/l	2.3	0.97	2.2	1.4
Copper (Cu)	mg/l	0.02	0.02	<0.01	0.02
Zinc (Zn)	mg/l	0.13	0.15	0.05	0.15
Oil and Grease	mg/l	1.3	<1.0	<1.0	3.0
Total Suspended Solids	mg/l	16	25	10	64
Total Dissolved Solids	mg/l	291	37	298	46
Total Solids	mg/l	332	74	304	98
Total Hardness ($CaCO_3$)	mg/l	156	60	160	16
Total Coliform	MPN/100 ml	7,000	110,000	13,000	330,000

TABLE 3

SUMMARY OF BIOASSAY RESULTS AT CONCLUSION OF 96-HOUR PERIOD FOR 13 FEBRUARY 1984 STORM DRAIN SAMPLES[a]

	Initial					96 Hour			
Test Conc.	pH	D.O. (mg/l)	Temp (°C)	Alk (mg/l $CaCO_3$)	Hardness (mg/l $CaCO_3$)	No. Dead	pH	D.O. (mg/l)	Temp (°C)
Control	7.9	6.9	15	56	56	0	7.8	7.4	14
100%	6.7	7.4	15	16	60	0	7.7	-	14
56%	6.9	7.2	15	34	56	10[b]	-	-	-
32%	7.0	7.0	15	42	56	0	7.7	7.4	14
18%	7.2	7.0	15	48	56	0	7.7	7.4	14
10%	7.5	7.0	15	54	56	0	7.7	7.6	14

[a] Test species consisted of rainbow trout (10 each) with average length of 6.1 cm and average weight of 4.21 g.

[b] Dissolved oxygen depleted due to aerator failure.

TABLE 4

SUMMARY OF BIOASSAY RESULTS AT CONCLUSION OF 96-HOUR PERIOD
FOR 13 MARCH 1984 STORM DRAIN SAMPLES[a]

	Initial					96 Hour			
Test Conc.	pH	D.O. (mg/l)	Temp (°C)	Alk (mg/l $CaCO_3$)	Hardness (mg/l $CaCO_3$)	No. Dead	pH	D.O. (mg/l)	Temp (°C)
Control	7.8	9.2	15	38	32	0	7.6	7.9	15
100%	8.1	8.0	15	142	160	0	8.1	8 1	15
56%	8.1	8.2	15	94	104	0	7.8	7.8	15
32%	8.0	8.4	15	58	88	0	7.7	7.6	15

[a] Test species consisted of rainbow trout (10 each) with average length of 4.14 cm and average weight of 1.01 g.

Wastewater Analysis Report

Kennedy/Jenks Engineers
Laboratory Division
657 Howard Street
San Francisco, California 94105
415-362-6065 495-6627

Received 2/13/84
Reported 2/29/84

For Kennedy/Jenks Engineers
Attention R. M. Block, Ph.D.
Address 657 Howard Street, San Francisco, CA 94105

(K/J 3193) Page 1 of 3

Lab. No.		84494	84495
Source Daly City, CA		Water Lake Merced	Storm Water Vista Grande Canal
Date Collected		2/13/84	2/13/84
Time Collected	Grab:	1430	1400
Collected by	T. Holsen, A. DeLeon		

Analysis	Units	Analytical Results	
pH (Field)	Unit	7.5	6.7
Temperature	°C	13	15
Dissolved Oxygen (Field)	mg/L	8.2	7.0
Total Alkalinity ($CaCO_3$)	mg/L	136	16
Conductivity @ 25° C	micromhos/cm	449	48
Chloride (Cl)	mg/L	41	7.3
Turbidity	NTU	7.4	15
Sulfate (SO_4)	mg/L	16	3.7
Sodium (Na)*	mg/L	37	3.5
Potassium (K)*	mg/L	2.3	0.97
Copper (Cu)*	mg/L	0.02	0.02
Zinc (Zn)*	mg/L	0.13	0.15
Oil and Grease	mg/L	1.3	<1
T.Suspended Solids	mg/L	16	25
T.Dissolved Solids(180°C)	mg/L	291	37
T. Solids	mg/L	332	74
Total Hardness ($CaCO_3$)	mg/L	156	60
Total Coliform	MPN/100ml	7,000	110,000

Comments:

* Analysis by Atomic Absorption Spectrophotometer

Analysis by: "Guidelines Establishing Test Procedures for the Analysis of Pollutants", Federal Register, Vol. 44, December 3, 1979.

Analyst TH, AD, JW, RS, NI Manager Everett R. Smith

tatic Acute Bioassay

Kennedy/Jenks Engineers
Laboratory Division

657 Howard Street
San Francisco, California 94105
415-362-6065
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or Kennedy/Jenks Engineers
ttention R. M. Block, Ph.D.
ddress 657 Howard Street, San Francisco, CA 94105

Received 2/13/84

Reported 2/29/84

(K/J 3193) Page 2 of 3

ab Sample No. 84494 Sample Description Lake Merced Water Sampling Procedure Grab
ate Sampled 2/13/84 Time Sampled 2:30 Sampled by TH, AD Test Begun 2/13/84 Test Ended 2/17/84

	Initial					24 Hours				48 Hours				72 Hours				96 Hours			
Test	pH	D.O.	Temp.	Alk.	Hard.	No.	pH	D.O.	Temp.	No.	pH	D.O.	Temp.	No.	pH	D.O.	Temp.	No.	pH	D.O.	Temp
Conc.		mg/l	°C			Dead		mg/l	°C	Dead		mg/l	°C	Dead		mg/l	°C	Dead		mg/l	°C
Control	7.9	6.9	15	56	56	0	7.5	5.2	14	0	7.6	6.3	14	0	7.6	7.2	14	0	7.8	7.4	14
100%	7.5	7.3	15	136	156	0	7.8	6.2	14	0	8.0	7.2	14	0	8.1	6.8	14	0	8.2	6.4	14
56%	7.5	7.2	15	104	104	0	7.5	5.0	14	0	7.7	6.1	14	0	7.8	6.8	14	0	7.8	7.4	14
32%	7.5	7.4	15	76	96	0	7.6	6.2	14	0	7.8	7.2	14	0	7.9	6.6	14	0	7.9	6.3	14
18%	7.5	7.4	15	72	76	0	7.6	6.3	14	0	7.8	7.6	14	0	7.8	7.2	14	0	7.9	6.2	14

est Species Rainbow Trout (Salmo gairdneri) Avg. Length 6.1 cm Max. Length 6.9 cm Min. Length 5.5 cm
ource of Test Species Alex Fish Company, San Rafael, CA Avg. Weight 4.21 g Max. Weight 6.21 g Min. Weight 3.14 g
rganisms/Conc. 10 Dilution Water De-chlorinated tap water
est Solution Volume 10 L Depth 12.5 cm Aeration Compressed Air Dead in Acclimation Tank <1 %
cclimation Tank Water De-chlorinated tap water (flow-thru) Acclimation Period 39 days Acclimation Temp. 13-15 °C

96 Hour LC_{50} >100 %
95% Confidence Limits for LC_{50} -
96 Hours Survival in Undiluted Wastewater 100%

Remarks:

nalyst TH, AD

Manager

eference: "Guidelines for Performing Static Acute Bioassays in Municipal and Industrial Wastewaters", July 1979, SWRCB and DFG.

tatic Acute Bioassay

Kennedy/Jenks Engineers
Laboratory Division

657 Howard Street
San Francisco, California 94105
415-362-6065 495-6627

or Kennedy/Jenks Engineers
ttention R. M. Block, Ph.D.
ddress 657 Howard Street, San Francisco, CA 94105

Received 2/13/84

Reported 2/29/84

(K/J 3193) Page 3 of 3

ıb Sample No. 84495
ate Sampled 2/13/84
Sample Description Storm Drain
Time Sampled 2:00
Sampled by TH, AD
Sampling Procedure Grab
Test Begun 2/13/84
Test Ended 2/17/84

	Initial					24 Hours				48 Hours				72 Hours				96 Hours			
Test Conc.	pH	D.O. mg/l	Temp. °C	Alk.	Hard.	No. Dead	pH	D.O. mg/l	Temp. °C	No. Dead	pH	D.O. mg/l	Temp. °C	No. Dead	pH	D.O. mg/l	Temp. °C	No. Dead	pH	D.O. mg/l	Temp. °C
Control	7.9	6.9	15	56	56	0	7.5	5.2	14	0	7.6	6.3	14	0	7.6	7.2	14	0	7.8	7.4	14
100%	6.7	7.4	15	16	60	0	7.0	4.6	14	0	7.1	6.8	14	0	7.2	6.8	14	0	7.7		14
56%	6.9	7.2	15	34	56	0	7.4	6.1	14	10*	6.8	<1*	14	10*	-	-	-	10*	-	-	-
32%	7.0	7.0	15	42	56	0	7.3	5.6	14	0	7.5	7.6	14	0	7.5	6.6	14	0	7.7	7.4	14
18%	7.2	7.0	15	48	56	0	7.3	5.4	14	0	7.6	7.6	14	0	7.4	6.4	14	0	7.7	7.4	14
10%	7.5	7.0	15	54	56	0	7.3	5.4	14	0	7.5	7.2	14	0	7.6	6.5	14	0	7.7	7.6	14

est Species Rainbow Trout (Salmo gairdneri)
ource of Test Species Alex Fish Company, San Rafael, CA
rganisms/Conc. 10 Dilution Water De-chlorinated tap water
est Solution Volume 10 L Depth 12.5 cm Aeration Compressed Air
cclimation Tank Water De-chlorinated tap water (flow-thru)

Avg. Length 6.1 cm
Avg. Weight 4.21 g
Max. Length 6.9 cm
Max. Weight 6.21 g
Min. Length 5.5 cm
Min. Weight 3.14 g
Dead in Acclimation Tank <1 %
Acclimation Period 39 days
Acclimation Temp. 13-15 °C

96 Hour LC_{50} >100 % Wastewater
95% Confidence Limits for LC_{50} - Wastewater
96 Hours Survival in Undiluted Wastewater 100%

Remarks: * D.O. fell - aerator stopped

nalyst TH, AD

Manager Everett R. Smith

eference: "Guidelines for Performing Static Acute Bioassays in Municipal and Industrial Wastewaters", July 1979 SWRCB and DFG.

Wastewater Analysis Report

Kennedy/Jenks Engineers
Laboratory Division
657 Howard Street
San Francisco, California 94105
415-362-6065 495-6627

Received 3/13/84
Reported 3/30/84

For Kennedy/Jenks Engineers
Attention R. M. Block, Ph.D.
Address 657 Howard Street, San Francisco, CA 94105

(K/J 3195) Page 1 of 3

Lab. No.		84799	84798
Source Daly City, CA		Water Lake Merced	Storm Water Vista Grande Canal
Date Collected		3/13/84	3/13/84
Time Collected	Grab:	1320	1305
Collected by	T. Holsen, L. Borok		

Analysis	Units	Analytical Results	
pH (Field)	Unit	8.1	7.3
Temperature	°C	16	16
Dissolved Oxygen (Field)	mg/L	7.6	8.6
Total Alkalinity ($CaCO_3$)	mg/L	142	16
Conductivity @ 25° C	micromhos/cm	515	64
Chloride (Cl)	mg/L	64	3.0
Turbidity	NTU	6.8	30
Sulfate (SO_4)	mg/L	4.0	14
Sodium (Na)*	mg/L	11	4.9
Potassium (K)*	mg/L	2.2	1.4
Copper (Cu)*	mg/L	<0.01	0.02
Zinc (Zn)*	mg/L	0.05	0.15
Oil and Grease	mg/L	<1.0	3.0
T.Suspended Solids	mg/L	10	64
T.Dissolved Solids(180°C)	mg/L	298	46
T. Solids	mg/L	304	98
Total Hardness ($CaCO_3$)	mg/L	160	16
Total Coliform	MPN/100ml	13,000	330,000

Comments:

* Analysis by Atomic Absorption Spectrophotometer

Analysis by: "Guidelines Establishing Test Procedures for the Analysis of Pollutants", Federal Register, Vol. 44, December 3, 1979.

Analyst TH, AD, JW, RS, NI Manager Everett R. Smith

tic Acute Bioassay

Kennedy/Jenks Engineers
Laboratory Division

657 Howard Street
San Francisco, California 94105
415-362-6065
495-6627

Received 3/13/84

Reported 3/30/84

r Kennedy/Jenks Engineers
tention R. M. Block, Ph.D.
ldress 657 Howard Street, San Francisco, CA 94105

b Sample No. 84799
te Sampled 3/13/84
Sample Description Lake Merced Water
Time Sampled 1320
Sampled by TH, LB
Sampling Procedure Grab
Test Begun 3/13/84
(K/J 3195) Page 2 of 3
Test Ended 3/17/84

	Initial					24 Hours				48 Hours				72 Hours				96 Hours			
Test	pH	D.O.	Temp.	Alk.	Hard.	No.	pH	D.O.	Temp.	No.	pH	D.O.	Temp.	No.	pH	D.O.	Temp.	No.	pH	D.O.	Temp
Conc.		mg/l	°C			Dead		mg/l	°C	Dead		mg/l	°C	Dead		mg/l	°C	Dead		mg/l	°C
Control	7.8	9.2	15	38	32	0	7.7	8.0	15	0	7.5	7.9	14	0	7.6	8.0	14	0	7.6	7.9	15
100%	8.1	8.0	15	142	160	0	8.0	7.9	15	0	8.1	8.6	14	0	8.2	8.8	14	0	8.1	8.1	15
56%	8.1	8.2	15	94	104	0	7.8	7.4	15	0	7.8	8.0	14	0	7.9	8.4	14	0	7.8	7.8	15
32%	8.0	8.4	15	58	88	0	7.7	7.2	15	0	7.7	8.0	14	0	7.7	7.9	14	0	7.7	7.6	15

st Species Rainbow Trout (Salmo gairdneri)
urce of Test Species Alex Fish Company, San Rafael, CA
ganisms/Conc. 10 Dilution Water De-chlorinated tap water
st Solution Volume 10 L Depth 12.5 cm Aeration Compressed Air
climation Tank Water De-chlorinated tap water (flow-thru)

Avg. Length 4.14 cm
Avg. Weight 1.01 g
Max. Length 5.0 cm
Max. Weight 1.83 g
Min. Length 3.6 cm
Min. Weight .64 g
Dead in Acclimation Tank <1 %
Acclimation Period 28 days
Acclimation Temp. 15°C

6 Hour LC_{50} >100 % water
5% Confidence Limits for LC_{50} – water
96 Hours Survival in Undiluted water 100%

Remarks:

alyst LB, TH

Manager Everett R. Smith

ference: "Guidelines for Performing Static Acute Bioassays in Municipal and Industrial Wastewaters", July 1979. SWRCB and DFG.

itic Acute Bioassay

Kennedy/Jenks Engineers
Laboratory Division

657 Howard Street
San Francisco, California 94105
415-362-6065 495-6627

Received 3/13/84

Reported 3/30/84

r Kennedy/Jenks Engineers
ention R. M. Block, Ph.D.
dress 657 Howard Street, San Francisco, CA 94105

(K/J 3195) Page 3 of 3

Sample No. 84798
e Sampled 3/13/84
Sample Description Storm Water Vista Grande Canal
Time Sampled 1305
Sampled by TH, LB
Sampling Procedure Grab
Test Begun 3/13/84
Test Ended 3/17/84

	Initial					24 Hours				48 Hours				72 Hours				96 Hours			
st	pH	D.O.	Temp.	Alk.	Hard.	No.	pH	D.O.	Temp.	No.	pH	D.O.	Temp.	No.	pH	D O.	Temp.	No.	pH	D.O.	Temp.
onc.		mg/l	°C			Dead		mg/l	°C	Dead		mg/l	°C	Dead		mg/l	°C	Dead		mg/l	°C
ontrol	7.8	9.2	15	38	32	0	7.7	8.0	15	0	7.5	7.9	14	0	7.6	8.0	15	0	7.6	7.9	15
100%	7.3	8.6	15	16	16	0	7.2	8.3	15	0	7.3	8.7	14	0	7.2	8.6	15	0	7.1	7.9	15
56%	7.6	9.0	15	26	32	1	7.4	8.0	15	1	7.4	8.6	14	1	7.4	8.4	15	1	7.3	7.6	15
32%	7.7	9.0	15	30	32	0	7.6	8.2	15	0	7.5	8.6	14	0	7.5	8.4	15	0	7.4	7.9	15
18%	7.8	9.0	15	36	44	0	7.5	7.4	15	0	7.5	8.0	14	0	7.6	8.2	15	0	7.5	7.9	15

t Species Rainbow Trout (Salmo gairdneri)
rce of Test Species Alex Fish Company, San Rafael, CA
anisms/Conc. 10 Dilution Water De-chlorinated tap water
t Solution Volume 10 L Depth 12.5 cm Aeration Compressed Air
limation Tank Water De-chlorinated tap water (flow-thru)

Avg. Length 4.14 cm
Avg. Weight 1.01 g
Max. Length 5.0 cm
Max. Weight 1.83 g
Min. Length 3.6 cm
Min. Weight .64 g
Dead in Acclimation Tank <1 %
Acclimation Period 28 days
Acclimation Temp. 15°C

5 Hour LC_{50} >100 % water
5% Confidence Limits for LC_{50} – water
6 Hours Survival in Undiluted water 100%

Remarks:

lyst LB, TH

Manager Brett R. Smith

rence "Guidelines for Performing Static Acute Bioassays in Municipal and Industrial Wastewaters", July 1979. SWRCB and DFG

DALY CITY/SFWD STORM WATER SAMPLING PROGRAM

City & County of San Francisco
Public Utilities Commission

San Francisco Water Departmen
Water Quality Divisior

FACSIMILE MESSAGE HEADER

Upcoming Daly City discharge sampling for stormwater at Vista Grande

To : Michael Abramson
Company : City of Daly City
FAX # : 991-8220
TEL # :

FROM : Phil Caskey, Ass't Mgr.

Total No. of pages (including cover page): 7

MESSAGE: Per our discussion on testing of storm water discharges at Vista Grande Tunnel during winter of 1992-93, the following is enclosed:

1) List of constituents to be tested.
   a) EPA Priority pollutants.
      1) Extractable organics (acid & base neutrals) EPA 625
      2) Priority metals (Sb, As, Be, Cd, Cr, Cu, Pb, Hg, Se, Ag, Ti, Zn)
   b) Miscellaneous chemical & physical tests: oil & grease, pH, total suspendend solids, conductivity, TOC, turbidity.
2) EPA organic analytical procedures.
3) Reference guide for field sampling.
4) Sample chain of custody form.

It is our understanding that you will sample approximately five times, depending on storm events, including two attempts to sample worst case scenarios, i.e. early (within a few hours) in a runoff event.

cc: L. Swanson
    M. Heo
    Reading File
    Lake Merced File

4/90

Ready Reference Guide to the
EPA Organic Analytic Procedures

Trace Analysis Laboratory, Inc. • 3423 Investment Blvd., #8 • Hayward, CA 94545 • (415) 783-6960 • Fax: (415) 783-1512

SOURCE DOCUMENTS FOR EPA PROCEDURES

DOCUMENT	DATE	MATRIX	PROCEDURE NOS.
EPA-600/4-88/039: Methods for the Determination of Organic Compounds in Drinking Water	December 1988	Drinking Water	500 Series
40 CFR Part 136: Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act	October 26, 1984	Effluent *(Wastewater Discharged to a Sewer or Body of Water)*	600 Series
SW-846, 2nd Edition, Revised: Test Methods for Evaluating Solid Waste	1985	Groundwater, Soil, Liquid and Solid Wastes	8000 Series

ANALYTES DETERMINED

METHODS 502.1 / 601 / 8010

Halogenated Volatile Organics (Purgeable Halocarbons) by GC

Benzyl chloride[6]
Bis (2-chloroethoxy) methane[6]
Bis (2-chloroisopropyl) ether[6]
Bromobenzene[5,8]
Bromochloromethane[5]
Bromodichloromethane
Bromoform
Bromomethane
Carbon tetrachloride
Chloroacetaldehyde[6]
Chloral[6]
Chlorobenzene
Chloroethane
2-Chloroethylvinyl ether[6,8]
Chloroform
1-Chlorohexane[6]
Chloromethane
Chloromethyl methyl ether[6]
2-Chlorotoluene[5,8]
4-Chlorotoluene[5,8]
Dibromochloromethane
1,2-Dibromoethane[5]
Dibromomethane[5,8]
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Dichlorodifluoromethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethene
cis-1,2-Dichloroethene[5]
trans-1,2-Dichloroethene
1,2-Dichloropropane
1,3-Dichloropropane[5]
2,2-Dichloropropane[5]
1,1-Dichloropropene[5]
cis-1,3-Dichloropropene
trans-1,3-Dichloropropene[5,8]
Methylene chloride
  (dichloromethane)
1,1,1,2-Tetrachloroethane[5,8]
1,1,2,2-Tetrachloroethane
Tetrachloroethene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethene
Trichlorofluoromethane
1,2,3-Trichloropropane[5,8]
Vinyl chloride

METHOD 8015

Nonhalogenated Volatile Organics by GC

Acrylamide
Carbon disulfide
Diethyl ether
Methyl ethyl ketone (MEK)
Methyl isobutyl ketone (MIBK)
Paraldehyde (trimer of acetaldehyde)

METHOD 502.2

Volatile Organics by GC

Includes analytes listed under both 502.1 and 503.1 plus 1,2-Dibromo-3-chloropropane.

METHODS 503.1 / 602 / 8020

Aromatic and Unsaturated Volatile Organics (Purgeable Aromatics) by GC

Benzene
Bromobenzene[5]
n-Butylbenzene[5]
sec-Butylbenzene[5]
tert-Butylbenzene[5]
Chlorobenzene
2-Chlorotoluene[5]
4-Chlorotoluene[5]
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Ethylbenzene
Hexachlorobutadiene[5]
Isopropylbenzene[5]
4-Isopropyltoluene[5]
Naphthalene[5]
n-Propylbenzene[5]
Styrene[5]
Tetrachloroethene[5]
Toluene
1,2,3-Trichlorobenzene[5]
1,2,4-Trichlorobenzene[5]
Trichloroethene[5]
1,2,4-Trimethylbenzene[5]
1,3,5-Trimethylbenzene[5]
o-Xylene[5,8]
m-Xylene[5,8]
p-Xylene[5,8]

METHODS 603 / 8030

by GC

Acrolein (Propenal)
Acrylonitrile
Acetonitrile[8]

METHOD 504

EDB and DBCP[5] by GC

1,2-Dibromoethane (EDB or Ethylene dibromide)
1,2-Dibromo-3-chloropropane (DBCP)

METHODS 604 / 8040

Phenols by GC

Phenol
2-Chlorophenol
2,4-Dichlorophenol
2,6-Dichlorophenol[8]
Trichlorophenols[8]
Tetrachlorophenols[8]
Pentachlorophenol
Cresol (methyl phenols)[8]
4,6-Dinitro-o-cresol[6]
2,4,6-Trichlorophenol[6]
4-Chloro-3-methylphenol
2,4-Dimethylphenol
2-Nitrophenol
4-Nitrophenol
2,4-Dinitrophenol
2-sec-Butyl-4,6-dinitrophenol (DNBP)[8]
2-Cyclohexyl-4,6-dinitrophenol[8]
2-Methyl-4,6-dinitrophenol

METHOD 605

Benzidines by GC

Benzidine
3,3'-Dichlorobenzidine

METHODS 606 / 8060

Phthalate Esters by GC

Benzyl butyl phthalate
Bis (2-ethylhexyl)phthalate
Di-n-butyl phthalate
Diethyl phthalate
Dimethyl phthalate
Di-n-octyl phthalate

METHODS 507 / 8140

Nitrogen and Phosphorus Containing Pesticides by GC

Alachlor[5]
Ametryn[5]
Atraton[5]
Atrazine[5]
Azinphos methyl[8]
Bolstar (Sulprofos)[8]
Bromacil[5]
Butachlor[5]
Butylate[5]
Carboxin[5]
Chlorpropham[5]
Chlorpyrifos[8]
Coumaphos[8]
Cycloate[5]
Demeton[8]
Diazinon
Dichlorvos
Dimethoate[8]
Diphenamid[5]
Disulfoton
Disulfoton sulfone[5]
Disulfoton sulfoxide[5]
EPN[8]
EPTC[5]
Ethoprop
Fenamiphos[5]
Fenarimol[5]
Fensulfothion[8]
Fenthion[8]
Fluridone[5]
Hexazinone[5]
Malathion[8]
Merphos
Methyl paraoxon[5]
Metolachlor[5]
Metribuzin[5]
Mevinphos
MGK 264[5]
Molinate[5]
Monocrotophos[8]
Naled[8]
Napropamide[5]
Norflurazon[5]
Parathion methyl[8]
Parathion[8]
Pebulate[5]
Phorate[8]
Prometon[5]
Prometryn[5]
Pronamide[5]
Propazine[5]
Ronnel[8]
Simazine[5]
Simetryn[5]
Stirofos (Tetrachlorvinphos)
Sulfotep[8]
Tebuthiuron[5]
TEPP[8]
Terbacil[5]
Terbufos[5]
Terbutryn[5]
Tokuthion (Prothiofos)[8]
Triademefon[5]
Trichlornate[8]
Tricyclazole[5]
Vernolate[5]

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5 This analyte is listed only under the 500 Series method referenced, and under other methods as footnoted for this analyte.
5a This analyte is listed only under EPA Method 505.
5b This analyte is listed only under EPA Method 508, and under other methods as footnoted for this analyte.
5c This analyte is listed only under EPA Method 524.2.
6 This analyte is listed only under the 600 Series method referenced, and under other methods as footnoted for this analyte.
6a EPA Method 610 utilizes either GC or HPLC.
8 This analyte is listed only under the 8000 Series method referenced, and under other methods as footnoted for this analyte.

ANALYTES DETERMINED

METHOD 607

itrosamines by GC

Nitrosodimethylamine
Nitrosodiphenylamine
N-Nitrosodi-n-propylamine

METHODS 505 / 508 / 608 / 8080

rganochlorine and other Organohalide esticides and Polychlorinated Biphenyls PCB's) by GC

achlor[5a]
drin
razine[5a]
lordane
hlordane-alpha[5]
lordane-gamma[5]
lorneb[5b]
lorobenzilate[5b]
lorothalonil[5b]
PA[5b]
-DDD[5b 8a]
-DDE[5b 8a]
-DDT[5b 8a]
eldrin
dosulfan I[5b 8a]
dosulfan II[5b 8a]
dosulfan sulfate[5b 8a]
drin
drin aldehyde[5b 8a]
ridiazole[5b]
H-alpha (α-BHC)[5b 6a]
H-beta (β-BHC)[5b 6a]
H-delta (δ-BHC)[5b 6a]
HCH-gamma (Lindane) (γ-BHC)
Heptachlor
Heptachlor epoxide
Hexachlorobenzene[5]
Hexachlorocyclopentadiene[5a]
Kepone[5]
Methoxychlor[5a]
cis-Nonachlor[5b]
trans-Nonachlor[5b]
PCB-1016 (Aroclor 1016)
PCB-1221 (Aroclor 1221)
PCB-1232 (Aroclor 1232)
PCB-1242 (Aroclor 1242)
PCB-1248 (Aroclor 1248)
PCB-1254 (Aroclor 1254)
PCB-1260 (Aroclor 1260)
cis-Permethrin[5b]
trans-Permethrin[5b]
Propachlor[5b]
Simazine[5a]
Toxaphene
Trifluralin[5b]

METHOD 508A

creening for Polychlorinated Biphenyls (PCB's) y GC

chlorobiphenyl (DCB)

METHODS 609 / 8090

itroaromatics and Cyclic Ketones by GC

itrobenzene[6]
-Dinitrotoluene
-Dinitrotoluene
Isophorone
Naphthoquinone[6]
Nitrobenzene

METHODS 610 / 8100 / 8310

olynuclear Aromatic Hydrocarbons by GC[6a] nd HPLC[8a]

enaphthene
enaphthylene
thracene
enzo(a)anthracene
nzo(a)pyrene
nzo(b)fluoranthene
enzo(ghi)perylene
nzo(j)fluoranthene[8]
nzo(k)fluoranthene
rysene
enzo(a,h)anthracene
benz(a,h)acridine[8]
Dibenz(a,j)acridine[8]
7H-Dibenzo(c,g)carbazole[8]
Dibenzo(a,e)pyrene[8]
Dibenzo(a,h)pyrene[8]
Dibenzo(a,i)pyrene[8]
Fluoranthene
Fluorene
Indeno(1,2,3-cd)pyrene
3-Methylcholanthrene[8]
Naphthalene
Phenanthrene
Pyrene

METHOD 611

Haloethers by GC

Bis(2-chloroethyl) ether
Bis(2-chloroethoxy) methane
Bis(2-chloroisopropyl) ether
4-Bromophenyl phenyl ether
4-Chlorophenyl phenyl ether

METHODS 612 / 8120

Chlorinated Hydrocarbons by GC

Benzotrichloride[6]
Benzyl chloride[6]
2-Chloronaphthalene
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Dichloromethylbenzene[6]
Hexabutadiene[6]
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclohexane[6]
Hexachlorocyclopentadiene
Hexachloroethane
Pentachlorohexane[6]
Tetrachlorobenzenes[6]
1,2,4-Trichlorobenzene

METHOD 613

Dioxin by GC/MS

2,3,7,8-Tetrachlorodibenzo-p-dioxin(2,3,7,8-TCDD)

METHODS 515.1 / 8150

Chlorinated Herbicides and Other Chlorinated Acids by GC

Acifluorfen[5]
Bentazon[5]
Chloramben[5]
2,4-D
Dalapon
2,4-DB
DCPA acid metabolites[5]
Dicamba
3,5-Dichlorobenzoic acid[5]
Dichlorprop
Dinoseb
5-Hydroxydicamba[5]
MCPA[8]
MCPP[8]
4-Nitrophenol[5]
Pentachlorophenol (PCP)[5]
Picloram[5]
2,4,5-T
2,4,5-TP

METHODS 524.1 / 524.2 / 624 / 8240

Volatile Organics (Purgeable Organics) by GC/MS

Benzene
Bromobenzene[5]
Bromochloromethane[5]
Bromodichloromethane
Bromoform
Bromomethane
n-Butylbenzene[5c]
sec-Butylbenzene[5c]
tert-Butylbenzene[5c]
Carbon tetrachloride
Chlorobenzene
Chloroethane
2-Chloroethylvinyl ether[6]
Chloroform
Chloromethane
2-Chlorotoluene[5]
4-Chlorotoluene[5]
Dibromochloromethane
1,2-Dibromo-3-chloropropane[5]
1,2-Dibromoethane[5]
Dibromomethane[5]
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Dichlorodifluoromethane[5]
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethene
cis-1,2-Dichloroethene[5]
trans-1,2-Dichloroethene
1,2-Dichloropropane
1,3-Dichloropropane[5]
2,2-Dichloropropane[5]
1,1-Dichloropropene[5]
cis-1,3-Dichloropropene
trans-1,3-Dichloropropene
Ethylbenzene
Hexachlorobutadiene[5c]
Isopropylbenzene[5c]
4-Isopropyltoluene[5c]
Methylene chloride
Naphthalene[5c]
n-Propylbenzene[5c]
Styrene[5]
1,1,1,2-Tetrachloroethane[5]
1,1,2,2-Tetrachloroethane
Tetrachloroethene
Toluene
1,2,3-Trichlorobenzene[5c]
1,2,4-Trichlorobenzene[5c]
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethene
Trichlorofluoromethane
1,2,3-Trichloropropane[5]
1,2,4-Trimethylbenzene[5c]
1,3,5-Trimethylbenzene[5c]
Vinyl chloride
o-Xylene[5]
m-Xylene[5]
p-Xylene[5]

METHODS 525 / 625 / 8250 / 8270

Semivolatile Organics (Extractable Organics) by GC/MS

Acenaphthene[6,8]
Acenaphthylene
Alachlor[5]
Aldrin[8]
Anthracene
Atrazine[5]
Benzidine[6,8]
Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(a)pyrene
Benzo(ghi)perylene
Benzyl butyl phthalate
Bis(2-chloroethyl)ether[6,8]
Bis(2-chloroethoxy)methane[6,8]
Bis(2-ethylhexyl)phthalate[6,8]
Bis(2-chloroisopropyl)ether[6,8]
4-Bromophenyl phenyl ether[6,8]
Chlordane[5]
2-Chlorobiphenyl[5]
4-Chloro-3-methylphenol[6,8]
2-Chloronaphthalene[6,8]
2-Chlorophenol[6,8]
4-Chlorophenyl phenyl ether[6,8]
Chrysene
4,4'-DDD[6,8]
4,4'-DDE[6,8]
4,4'-DDT[6,8]
Dibenzo(a,h)anthracene
Di-n-butylphthalate
1,2-Dichlorobenzene[6,8]
1,3-Dichlorobenzene[6,8]
1,4-Dichlorobenzene[6,8]
3,3'-Dichlorobenzidine[6,8]
2,3-Dichlorobiphenyl[5]
2,4-Dichlorophenol[6,8]
Dieldrin[6,8]
Di(2-ethylhexyl)adipate[5]
Di(2-ethylhexyl)phthalate[5]
Diethylphthalate
2,4-Dimethylphenol[6,8]
Dimethylphthalate
2,4-Dinitrophenol[6,8]
2,4-Dinitrotoluene[6,8]
2,6-Dinitrotoluene[6,8]
Di-n-octylphthalate[6,8]
Endosulfan I[6,8]
Endosulfan II[6,8]
Endosulfan sulfate[6,8]
Endrin[5]
Endrin aldehyde[6,8]
Fluoranthene[6,8]
Fluorene
HCH-alpha (α-BHC)[6,8]
HCH-beta (β-BHC)[6,8]
HCH-delta (δ-BHC)[6,8]
HCH-gamma (Lindane) (γ-BHC)[5]
Heptachlor[5]
Heptachlor epoxide[5]
2,2',3,3',4,4',6-Heptachlorobiphenyl[5]
Hexachlorobenzene
2,2',4,4',5,5'-Hexachlorobiphenyl[5]
Hexachlorobutadiene[6,8]
Hexachlorocyclopentadiene
Hexachloroethane[6,8]
Indeno(1,2,3-cd)pyrene
Isophorone[6,8]
Methoxychlor[5]
2-Methyl-4,6-dinitrophenol[6,8]
Naphthalene[6,8]
Nitrobenzene[6,8]
2-Nitrophenol[6,8]
4-Nitrophenol[6,8]
N-Nitrosodimethylamine[6,8]
N-Nitrosodiphenylamine[6,8]
N-Nitrosodi-n-propylamine[6,8]
2,2',3,3',4,5',6,6'-Octachlorobiphenyl[5]
PCB-1016 (Aroclor 1016)[6,8]
PCB-1221 (Aroclor 1221)[6,8]
PCB-1232 (Aroclor 1232)[6,8]
PCB-1242 (Aroclor 1242)[6,8]
PCB-1248 (Aroclor 1248)[6,8]
PCB-1254 (Aroclor 1254)[6,8]
PCB-1260 (Aroclor 1260)[6,8]
2,2',3',4,6-Pentachlorobiphenyl[5]
Pentachlorophenol
Phenanthrene
Phenol[6,8]
Pyrene
Simazine[5]
2,2',4,4'-Tetrachlorobiphenyl[5]
Toxaphene[5]
1,2,4-Trichlorobenzene[6,8]
2,4,5-Trichlorobiphenyl[5]
2,4,6-Trichlorophenol[6,8]

METHOD 531.1

N-Methylcarbamoyloximes and N-Methylcarbamates by HPLC

Aldicarb
Aldicarb sulfone
Aldicarb sulfoxide
Baygon
Carbaryl
Carbofuran
3-Hydroxycarbofuran
Methiocarb
Methomyl
Oxamyl

---

[5] This analyte is listed only under the 500 Series method referenced, and under other methods as footnoted for this analyte.
[5a] This analyte is listed only under EPA Method 505.
[5b] This analyte is listed only under EPA Method 508, and under other methods as footnoted for this analyte.
[5c] This analyte is listed only under EPA Method 524.2.
[6] This analyte is listed only under the 600 Series method referenced, and under other methods as footnoted for this analyte.
[6a] EPA Method 610 utilizes either GC or HPLC.
[8] This analyte is listed only under the 8000 Series method referenced, and under other methods as footnoted for this analyte
[8a] EPA Method 8100 utilizes only GC.
EPA Method 8310 utilizes only HPLC.

4/89

TAL Ready Reference Guide for Field Sampling

Trace Analysis Laboratory, Inc. • 3423 Investment Blvd., #8 • Hayward, CA 94545 • (415) 783-6960 • Fax: (415) 783-1512

PROCEDURE	SAMPLE TYPE					
	WATER/LIQUID[5]			SOIL/SLUDGE		
	Container[1]	Quantity[4]	Preservation[5]	Container[1][2][3]	Quantity	Preservation
VOLATILE ORGANICS						
601/8010	G-TLS	2-40ml	Cool 4°C(4)	B/ST, G-TLC	4 oz.	Cool 4°C
8015	G-TLS	2-40ml	Cool 4°C(4)	B/ST, G-TLC	4 oz.	Cool 4°C
602/8020	G-TLS	2-40ml	Cool 4°C, HCl to pH < 2(4)	B/ST, G-TLC	4 oz.	Cool 4°C
624/8240	G-TLS	2-40ml	Cool 4°C(4)	B/ST, G-TLC	4 oz.	Cool 4°C
Acetate, Acetone, Alcohols	G-TLS	2-40ml	Cool 4°C	B/ST, G-TLC	4 oz.	Cool 4°C
BTXE	G-TLS	2-40ml	Cool 4°C, HCl to pH < 2(4)	B/ST, G-TLC	4 oz.	Cool 4°C
TPH as Gas	G-TLS	2-40ml	Cool 4°C, HCl to pH < 2(4)	B/ST, G-TLC	4 oz.	Cool 4°C
TPH as Gas + BTXE	G-TLS	2-40ml	Cool 4°C, HCl to pH < 2(4)	B/ST, G-TLC	4 oz.	Cool 4°C
Trihalomethanes	G-TLS	2-40ml	Cool 4°C(4)	B/ST, G-TLC	4 oz.	Cool 4°C
SEMI-VOLATILE ORGANICS						
604/8040	G-TLC	1 liter	Cool 4°C(4)	B/ST, G-TLC	8 oz.	Cool 4°C
608/8080	G-TLC	1 liter	Cool 4°C	B/ST, G-TLC	8 oz.	Cool 4°C
612/8120	G-TLC	1 liter	Cool 4°C	B/ST, G-TLC	8 oz.	Cool 4°C
8150	G-TLC	1 liter	Cool 4°C	B/ST, G-TLC	8 oz.	Cool 4°C
613/8280 (Dioxin)	G-TLC	1 liter	Cool 4°C(4)	B/ST, G-TLC	8 oz.	Cool 4°C
625/8250/8270	G-TLC	2 liters	Cool 4°C(4)	B/ST, G-TLC	8 oz.	Cool 4°C
EDB	G-TLC	1 liter	Cool 4°C	B/ST, G-TLC	8 oz.	Cool 4°C
TPH as Diesel, Jet Fuel or Kerosene	G-TLC	1 liter	Cool 4°C	B/ST, G-TLC	8 oz.	Cool 4°C
METALS						
Chromium VI	P, G	100ml	Cool 4°C	P, G	4 oz.	Cool 4°C
Mercury	P, G	100ml	Cool 4°C, HNO_3 to pH < 2	P, G	4 oz.	Cool 4°C
Organic Lead	G-TLC	1 liter	Cool 4°C	G-TLC	4 oz.	Cool 4°C
All Other Metals	P, G	300ml	Cool 4°C, HNO_3 to pH < 2	P, G	4 oz.	Cool 4°C
GENERAL AND INORGANICS						
Alkalinity	P, G	100ml	Cool 4°C	B/ST, P, G	4 oz.	Cool 4°C
BOD_5	P, G	100ml	Cool 4°C	—	—	—
Boron	P, G	200ml	Cool 4°C	B/ST, P, G	4 oz.	Cool 4°C
COD	P, G	100ml	Cool 4°C, H_2SO_4 to pH < 2	—	—	—
Chloride	P, G	100ml	None	B/ST, P, G	4 oz.	None

(1) B/ST - Brass or Steel Tube G - Glass P - Polyethylene TLC - Teflon-lined Cap TLS - Teflon-lined Septum

(2) The State of California specifies brass or steel tubes for the collection of soil and firm sludge samples

(3) Loose sludges should be collected in jars, not tubes.

PROCEDURE	SAMPLE TYPE					
	WATER/LIQUID			SOIL/SLUDGE		
	Container[1]	Quantity[2]	Preservation[3]	Container[1][2]	Quantity	Preservation
GENERAL AND INORGANICS (continued)						
anide	P, G	1 liter	Cool 4°C, NaOH to pH > 12, ascorbic acid as needed	B/ST, P, G	4 oz.	Cool 4°C
~~ashpoint~~	~~G-TLC~~	~~100ml~~	~~None~~	~~B/ST, G-TLC~~	~~4 oz.~~	~~None~~
uoride	P	500ml	None	—	—	—
neral Mineral	P, G	1 liter + 500ml	1 liter - Cool 4°C 500ml - Cool 4°C, HNO_3 to pH < 2	—	—	—
neral Physical	P, G	500ml	Cool 4°C	—	—	—
ardness	P, G	100ml	HNO_3 or H_2SO_4 to pH < 2	—	—	—
rate	P, G	100ml	Cool 4°C, 2ml H_2SO_4/L	B/ST, P, G	4 oz.	Cool 4°C
itrite	P, G	100ml	Cool 4°C	B/ST, P, G	4 oz.	Cool 4°C
and Grease	G-TLC	1 liter	Cool 4°C, HCl to pH < 2	B/ST, G-TLC	8 oz.	Cool 4°C
enolics	G-TLC	1 liter	Cool 4°C, H_2SO_4 to pH < 2	B/ST, G-TLC	8 oz.	Cool 4°C
osphorus	G-TLC	100ml	Cool 4°C, 1ml HCl/L	B/ST, G-TLC	8 oz.	Cool 4°C
H	P, G	50ml	Cool 4°C	B/ST, P, G	4 oz.	Cool 4°C
activity in Acid and Base	P, G	500ml	Cool 4°C	B/ST, P, G	4 oz.	Cool 4°C
activity, Water	P, G	200ml	Cool 4°C	B/ST, P, G	4 oz.	Cool 4°C
lids, Dissolved (TDS)	P, G	200ml	Cool 4°C	—	—	—
lids, Suspended (TSS)	P, G	200ml	Cool 4°C	—	—	—
lids, Total (TS)	P, G	200ml	Cool 4°C	—	—	—
ecific Conductance	P, G	250ml	Cool 4°C	—	—	—
ecific Gravity	P, G	25ml	Ambient	B/ST, P, G	4 oz.	Ambient
el Corrosion	P, G	500ml	Cool 4°C	—	—	—
lfate	P, G	200ml	Cool 4°C	B/ST, P, G	4 oz.	Cool 4°C
lfide	P, G	500ml	Cool 4°C, $ZnCO_2CH_3$ + NaOH to pH > 9	B/ST, P, G	4 oz.	Cool 4°C

B/ST - Brass or Steel Tube G - Glass P - Polyethylene TLC - Teflon-lined Cap TLS - Teflon-lined Septum

The State of California specifies brass or steel tubes for the collection of soil and firm sludge samples. Loose sludges should be collected in jars, not tubes.

If residual free chlorine is present in the sample, which may occur in chlorinated drinking water or treated sewage, preserve with 0.008% $Na_2S_2O_3$.

For organic liquids, such as oils, solvents, or fuels, no chemical preservatives should be used. Sample sizes should be 5ml for each ORGANICS procedure, 100ml for any number of METALS procedures, and 100ml for each GENERAL AND INORGANICS procedure.

FUEL STORAGE TANK TESTS REQUIRED (LUFT and SFRWQCB)

TANK TYPE	TESTS REQUIRED FOR WATER OR SOIL
Diesel	TPH as Diesel, BTXE
Gasoline	TPH as Gas, BTXE[5]
Jet Fuel	TPH as Jet Fuel, BTXE
Kerosene	TPH as Kerosene, BTXE
Unknown	TPH as Gas and Diesel, O & G 503E, 8010/BTXE (or 8240 + 10 peaks)[6]

Constituents to be Measured

EPA Priority Pollutants

1. Extractable Organics (Acid and Base Neutral) EPA625
2. Priority Metals (Sb, As, Be, Cd, Cr, Cu, Pb, Hg Ni, Se, Ag Tl, Zn)

Miscellaneous:

pH	$18.00
Oil + Grease	87.00
Total Solids	18.00
Specific Conductance	18.00
Turbidity	18.00
TOC	58.00
	$217.00

CHAIN OF CUSTODY REPORT

REPORT TO:

ADDRESS:

PHONE:

PROJECT NAME/SITE:

SAMPLER:

DATE:

SAMPLE ID#/ STATION	SAMPLE DESCRIPTION	NUMBER OF CONT.	TYPE CONT.	SAMPLING TIME/DATE	ANALYSIS REQUESTED										REMARKS	SAMPLE NUMBER

RELINQUISHED BY	DATE	TIME:	RECEIVED BY:	TRAVEL TIME:		
				ON SITE TIME:		
RELINQUISHED BY:	DATE	TIME:	RECEIVED BY:	OTHER:		
				WERE SAMPLES:	YES	NO
RELINQUISHED BY:	DATE	TIME:	RECEIVED IN LAB BY:	PRESERVED ?		
				IN GOOD CONDITION?		

Figure III-29

DALY CITY SAMPLING RESULTS - 1993

CITY OF DALY CITY INTER-OFFICE MEMORANDUM

DATE: January 28, 1993

TO: Michael D. Abramson, Director of Water and Wastewater Resources

FROM: Greg Mayer, Assistant Chief of Operations

SUBJECT: First Sample Results: Vista Grande Storm Water Runoff

As agreed to by Phil Caskey, Assistant Manager - Water Quality Division, SFWD, in a telephone conversation on January 6, 1993, the first of a series of storm water discharges was sampled from the Vista Grande structure at 6:00 p.m. on Tuesday, January 12, 1993.

The following test were run by the DWWR laboratory with these results:

Total Solids	2,900 mg/L
Turbidity	20 ntu
pH	7.5
Oil and Grease	3.2 mg/L
conductivity	46 µm hos

The remaining tests, done at Sequoia Analytical Laboratory, were conductivity, T.O.C. and EPA Priority Pollutants - Extractable Organics EPA 625.

Results are attached.

Greg Mayer

Greg Mayer
Assistant Chief of Operations

GM:mr
M93:048

Attachment

cc: Paul Fako

SEQUOIA ANALYTICAL
680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

JAN 2 8 1993

WQ

City of Daly City
153 Lake Merced Blvd.
Daly City, CA 94015
Attention: Paul Fako

Client Project ID: Vista Grande Channel Stormwater Flow
Sample Descript: Water
Lab Number: 301-1381

Sampled: Jan 13, 1993
Received: Jan 13, 1993
Analyzed: Jan 14-22 1993
Reported: Jan 27, 1993

E.P.A. PRIORITY POLLUTANTS: METALS

Analyte	Detection Limit µg/L (ppb)	Sample Results µg/L (ppb)
Antimony	5.0	N.D.
Arsenic	5.0	N.D.
Beryllium	10	N.D.
Cadmium	10	N.D.
Chromium	10	N.D.
Copper	10	N.D.
Lead	5.0	38
Mercury	0.20	N.D.
Nickel	50	N.D.
Selenium	5.0	N.D.
Silver	10	N.D.
Thallium	5.0	N.D.
Zinc	10	79

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Diane Elich Lawver
Project Manager

SEQUOIA ANALYTICAL
680 Chesapeake Drive • Redwood City, CA 94063
(415) 364-9600 • FAX (415) 364-9233

wa

City of Daly City
153 Lake Merced Blvd.
Daly City, CA 94015
Attention: Paul Fako

Client Project ID: Vista Grande Channel Stormwater Flow
Sample Descript: Water
Lab Number: 301-1381

Sampled Jan 13, 1993
Received Jan 13, 1993
Analyzed. see below
Reported Jan 27 1993

LABORATORY ANALYSIS

Analyte	Date Analyzed	Detection Limit mg/L	Sample Result mg/L
Titanium	1/20/93	0.020	0.059

Analytes reported as N.D. were not present above the stated limit of detection.

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Diane Elich Lawver
Project Manager

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JAN 2 8 1993

City of Daly City	Client Project ID.	Vista Grande Channel Stormwater Flow		Sampled:	Jan 13, 1993
153 Lake Merced Blvd.	Sample Descript.	Water		Received:	Jan 13, 1993
Daly City, CA 94015				Analyzed:	see below
Attention. Paul Fako	Lab Number:	301-1381		Reported:	Jan 27, 1993

LABORATORY ANALYSIS

Analyte	Date Analyzed	Detection Limit	Sample Result
Total Organic Carbon, mg/L	1/19/93	1.0	3.9
Specific Cond., µmhos/cm	1/13/93	1.0	39

Analytes reported as N.D were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Diane Elich Lawver
Project Manager

SEQUOIA ANALYTICAL

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(415) 364-9600 • FAX (415) 364-9233

City of Daly City
153 Lake Merced Blvd.
Daly City, CA 94015
Attention: Paul Fako

Client Project ID: Vista Grande Channel Stormwater Flow
Sample Descript. Water, Grab
Analysis Method. EPA 625
Lab Number 301-1381

Sampled: Jan 13 1993
Received. Jan 13 1993
Extracted. Jan 14 1993
Analyzed: Jan 15, 1993
Reported: Jan 27, 1993

ACID & BASE/NEUTRALS by GC/MS (EPA 625)

Analyte	Detection Limit μg/L	Sample Results μg/L
Acenaphthene	2.0	N.D.
Acenaphthylene	2.0	N.D.
Aniline	2.0	N.D.
Anthracene	2.0	N.D.
Benzidine	50	N.D.
Benzoic Acid	10	N.D.
Benzo(a)anthracene	2.0	N.D.
Benzo(b)fluoranthene	2.0	N.D.
Benzo(k)fluoranthene	2.0	N.D.
Benzo(g,h,i)perylene	2.0	N.D.
Benzo(a)pyrene	2.0	N.D.
Benzyl alcohol	2.0	N.D.
Bis(2-chloroethoxy)methane	2.0	N.D.
Bis(2-chloroethyl)ether	2.0	N.D.
Bis(2-chloroisopropyl)ether	2.0	N.D.
Bis(2-ethylhexyl)phthalate	10	N.D.
4-Bromophenyl phenyl ether	2.0	N.D.
Butyl benzyl phthalate	2.0	N.D.
4-Chloroaniline	2.0	N.D.
2-Chloronaphthalene	2.0	N.D.
4-Chloro-3-methylphenol	2.0	N.D.
2-Chlorophenol	2.0	N.D.
4-Chlorophenyl phenyl ether	2.0	N.D.
Chrysene	2.0	N.D.
Dibenz(a,h)anthracene	2.0	N.D.
Dibenzofuran	2.0	N.D.
Di-N-butyl phthalate	10	N.D.
1,3-Dichlorobenzene	2.0	N.D.
1,4-Dichlorobenzene	2.0	N.D.
1,2-Dichlorobenzene	2.0	N.D.
3,3-Dichlorobenzidine	10	N.D.
2,4-Dichlorophenol	2.0	N.D.
Diethyl phthalate	2.0	N.D.
2,4-Dimethylphenol	2.0	N.D.
Dimethyl phthalate	2.0	N.D.
4,6-Dinitro-2-methylphenol	10	N.D.
2,4-Dinitrophenol	10	N.D.

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(415) 364-9600 • FAX (415) 364-9233

JAN 2 [illegible] 93

City of Daly City
153 Lake Merced Blvd.
Daly City, CA 94015
Attention: Paul Fako

Client Project ID: Vista Grande Channel Stormwater Flow
Sample Descript. Water, Grab
Analysis Method: EPA 625
Lab Number: 301-1381

Sampled Jan 13, 1993
Received Jan 13, 1993
Extracted Jan 14, 1993
Analyzed Jan 15, 1993
Reported Jan 27, 1993

ACID & BASE/NEUTRALS by GC/MS (EPA 625)

Analyte	Detection Limit µg/L	Sample Results µg/L
2,4-Dinitrotoluene	2.0	N.D.
2,6-Dinitrotoluene	2.0	N.D.
Di-N-octyl phthalate	2.0	N.D.
Fluoranthene	2.0	N.D.
Fluorene	2.0	N.D.
Hexachlorobenzene	2.0	N.D.
Hexachlorobutadiene	2.0	N.D.
Hexachlorocyclopentadiene	2.0	N.D.
Hexachloroethane	2.0	N.D.
Indeno(1,2,3-cd)pyrene	2.0	N.D.
Isophorone	2.0	N.D.
2-Methylnaphthalene	2.0	N.D.
2-Methylphenol	2.0	N.D.
4-Methylphenol	2.0	N.D.
Naphthalene	2.0	N.D.
2-Nitroaniline	10	N.D.
3-Nitroaniline	10	N.D.
4-Nitroaniline	10	N.D.
Nitrobenzene	2.0	N.D.
2-Nitrophenol	2.0	N.D.
4-Nitrophenol	10	N.D.
N-Nitrosodiphenylamine	2.0	N.D.
N-Nitroso-di-N-propylamine	2.0	N.D.
Pentachlorophenol	10	N.D.
Phenanthrene	2.0	N.D.
Phenol	2.0	N.D.
Pyrene	2.0	N.D.
1,2,4-Trichlorobenzene	2.0	N.D.
2,4,5-Trichlorophenol	10	N.D.
2,4,6-Trichlorophenol	2.0	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Diane Elich Lawver
Project Manager

DATE

DRAFT

Mr. Phil Caskey, Assistant Manager
San Francisco Water Department
Water Quality Division
P.O. Box 730
Millbrae, CA 94030

Subject: Stormwater Sample Event #2, Vista Grande Tunnel

Dear Mr. Caskey:

preceeded by a couple weeks dry
sampled in the 1st few hrs

Vista Grande Tunnel stormwater flows were sampled for a second time on February 7, 1993, at 15:30 hours. This sampling event would approximate a worst case scenario as described in the memo of January 4, 1993.

This samples were taken about 1-1/2 hours after the beginning of a storm event/and after 2 to 2-1/2 weeks of dry weather. The channel leading to Vista Grande Tunnel was charged to about 60% of its height and flowing at about 2 ft/sec.

As in the previous sample event, the following tests were conducted in the laboratory at our facility with listed results:

Conductivity	40 umhos
Total Solids	0.06% TS
pH	6.4
Turbidity	6.0 NTU
Oil and Grease	2.0 mg/~~Liter~~

1% = 1000ppm

The remainder of required analyses were sent to Sequoia Analytical Laboratory for testing. These included EPA priority pollutants (extractable organics and priority metals - EPA 625). The results are attached.

Sincerely,

Greg Mayer
Assistant Chief of Operations

GM:lee
L93-044

Attachments

cc: Paul R. Fako
Chief of Operations

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FEB 2 –

Da

No. San Mateo Co. Sanitation Dist.
153 Lake Merced Blvd.
Daly City, CA 94015
Attention: Paul Fako

Client Project ID: -
Sample Descript: Water, Vista Grande
Lab Number: 3B42301

Sampled: Feb 7, 1993
Received: Feb 8, 1993
Analyzed: Feb 12-17, 1993
Reported: Feb 21, 1993

E.P.A. PRIORITY POLLUTANTS: METALS

Analyte	Detection Limit µg/L (ppb)	Sample Results µg/L (ppb)
Antimony	5.0	N.D.
Arsenic	5.0	N.D.
Beryllium	10	N.D.
Cadmium	10	N.D.
Chromium	10	N.D.
Copper	10	23
Lead	5.0	46
Mercury	0.20	N.D.
Nickel	50	N.D.
Selenium	5.0	N.D.
Silver	10	N.D.
Thallium	5.0	N.D.
Zinc	10	150

Analytes reported as N.D. were not present above the stated limit of detection.

SEQUOIA ANALYTICAL

Diane Elich Lawver
Project Manager

SEQUOIA ANALYTICAL
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FEB 2 3 1993

No. San Mateo Co. Sanitation Dist.
153 Lake Merced Blvd.
Daly City, CA 94015
Attention: Paul Fako

Client Project ID: -
Sample Descript: Water
Lab Number: 3B42301

Sampled Feb 7, 1993
Received Feb 8, 1993
Analyzed see below
Reported Feb 21, 1993

LABORATORY ANALYSIS

Analyte	Date Analyzed	Detection Limit mg/L	Sample Result mg/L
Total Organic Carbon	2/18/93	1.0	9.1

Analytes reported as N.D. were not present above the stated limit of detection

SEQUOIA ANALYTICAL

Diane Elich Lawver
Project Manager

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(415) 364-9600 • FAX (415) 364-9233

No. San Mateo Co. Sanitation Dist.
153 Lake Merced Blvd.
Daly City, CA 94015
Attention: Paul Fako

Client Project ID: -
Sample Descript: Water
Analysis Method: EPA 625
Lab Number: 3B42301

Sampled: Feb 7, 1993
Received: Feb 8, 1993
Extracted: Feb 11, 1993
Analyzed: Feb 11, 1993
Reported: Feb 21, 1993

ACID & BASE/NEUTRALS by GC/MS (EPA 625)

Analyte	Detection Limit μg/L	Sample Results μg/L
Acenaphthene	2.0	N.D.
Acenaphthylene	2.0	N.D.
Aniline	2.0	N.D.
Anthracene	2.0	N.D.
Benzidine	50	N.D.
Benzoic Acid	10	N.D.
Benzo(a)anthracene	2.0	N.D.
Benzo(b)fluoranthene	2.0	N.D.
Benzo(k)fluoranthene	2.0	N.D.
Benzo(g,h,i)perylene	2.0	N.D.
Benzo(a)pyrene	2.0	N.D.
Benzyl alcohol	2.0	N.D.
Bis(2-chloroethoxy)methane	2.0	N.D.
Bis(2-chloroethyl)ether	2.0	N.D.
Bis(2-chloroisopropyl)ether	2.0	N.D.
Bis(2-ethylhexyl)phthalate	10	17
4-Bromophenyl phenyl ether	2.0	N.D.
Butyl benzyl phthalate	2.0	2.0
4-Chloroaniline	2.0	N.D.
2-Chloronaphthalene	2.0	N.D.
4-Chloro-3-methylphenol	2.0	N.D.
2-Chlorophenol	2.0	N.D.
4-Chlorophenyl phenyl ether	2.0	N.D.
Chrysene	2.0	N.D.
Dibenz(a,h)anthracene	2.0	N.D.
Dibenzofuran	2.0	N.D.
Di-N-butyl phthalate	10	N.D.
1,3-Dichlorobenzene	2.0	N.D.
1,4-Dichlorobenzene	2.0	N.D.
1,2-Dichlorobenzene	2.0	N.D.
3,3-Dichlorobenzidine	10	N.D.
2,4-Dichlorophenol	2.0	N.D.
Diethyl phthalate	2.0	N.D.
2,4-Dimethylphenol	2.0	N.D.
Dimethyl phthalate	2.0	N.D.
4,6-Dinitro-2-methylphenol	10	N.D.
2,4-Dinitrophenol	10	N.D.

APPENDIX F

SAN FRANCISCO BEST MANAGEMENT PRACTICES VICENTE STORMWATER AND WASTEWATER TESTING

City and County of San Francisco

Department of Public Works
Bureau of Engineering

TO: Mickey Heo

DATE: 11/9/92

FM: Karen Kubick K3

RE: Lake Merced

Our San Francisco Best Management Practices Program (BMP) has developed baseline measurements for street run-off (attached), which may be of use to you in developing general assumptions for run-off water quality into Lake Merced from the Cal Trans Highway 35 (Skyline Boulevard).

For further detailed monitoring of Highway 35, Cal Trans should be contacted. The Department of Public Works has no jurisdiction over discharges to Lake Merced. When the highway was constructed the Water Department authorized installation of the catch-basins. Perhaps some agreement with Cal Trans was developed regarding the run-off quality.

I have also attached a copy of the Regional Water Quality Control Board's draft Basin Plan, which includes water quality objectives for fresh surface waters (Table III-2B). In regards to the Daly City storm water over-flow into Lake Merced, the Water Department should contact Steven Ritchie at the Regional Water Quality Control Board with questions regarding what is typically monitored in stormwater permits.

Copies w/o attachments except where noted
cc: Chris Moriaka
Cheryl Davis
Leonard Swanson w/ attachments
Don Munakata
File 14.1.5.7. w/ attachments

SENT BY: XEROX Telecopier 7017; 4- 6-92 ; 2:57PM ; JMM WCR-1-

Job# 1064.0151

Post-it™ brand fax transmittal memo 7671	# of pages ▸ 1
To Frank Filice	From S. Hunt
Co. SF/DPW	Co. JMM
Dept.	Phone # 510 933-2250
Fax # 415 554 8203	Fax #

BMP Baseline Info.

Vicente Data

cente Storm

Mean

onstituent ug/	11/2	12/1	12/1	1/	2/	2/	3/1	3/1	3/2	3/2	3/2	mean	st.d	mi	ma
rseni	2.00	3.30	2.30	2.20	1.00	1.2	1.70	1.70	1.70	1.70	1.90	1.88	0.58	1.00	3.30
admiu	8.50	8.00	8.00	7.20	12.50	12.5	19.00	15.30	15.30	4.20	4.20	10.43	4.60	4.20	19.00
Chromiu	12.00	52.80	21.10	3.51	8.20	3.6	7.10	6.40	4.00	3.40	5.00	11.56	13.96	3.40	52.80
Coppe	120.00	90.00	43.00	85.00	56.00	19	36.00	186.00	47.00	73.00	70.00	75.00	44.24	19.00	186.00
Lea	37.40	44.20	19.70	15.00	32.80	16.9	21.20	75.60	12.90	14.40	17.30	27.95	18.03	12.90	75.60
Nicke	30.50	84.80	75.80	12.90	7.80	4.6	9.30	6.30	7.80	11.30	11.00	23.83	27.48	4.60	84.80
Silve	4.30	0.10	1.10	3.98	2.50	0.4	0.30	0.20	0.50	2.70	17.40	3.04	4.77	0.10	17.40
Zin	451.00	461.00	262.00	191.00	337.00	123	250.00	309.00	172.00	194.00	200.00	268.18	106.09	123.00	461.00
Mercur	0.72	0.25	0.25	0.47	0.64	0.17	0.13	0.35	0.10	0.19	0.42	0.34	0.20	0.10	0.72
Rainfall (in	0.30	0.53	0.93	0.38	0.99	1.10	0.78	0.65	0.47	0.15	0.15	0.58	0.32	0.15	1.10

Vicente Sanitary wastewater

	11/2	12/1	1/	2/	2/	3/1	3/1	3/2	3/2	mean	st.d	mi	ma
Arseni	2.60	1.80	2.20	12.90	1.3	6.00	1.80	2.70	2.90	3.80	3.46	1.30	12.90
Cadmiu	8.50	8.00	7.20	12.50	12.5	15.30	15.30	15.30	5.00	11.07	3.74	5.00	15.30
Chromiu	8.70	15.10	7.28	6.00	23.8	6.70	2.10	4.70	5.70	8.90	6.24	2.10	23.80
Coppe	101.00	16.10	41.00	88.00	84	90.00	34.00	135.00	91.00	75.57	35.45	16.10	135.00
Lea	23.80	35.70	17.40	27.30	39.8	33.40	24.90	23.30	12.20	26.42	8.28	12.20	39.80
Nicke	11.70	48.60	18.00	13.60	25	11.20	6.70	9.40	49.00	21.47	15.44	6.70	49.00
Silve	5.40	2.30	2.04	1.40	1.7	0.90	0.60	1.70	4.70	2.30	1.56	0.60	5.40
Zin	217.00	670.00	175.00	330.00	545	226.00	360.00	174.00	221.00	324.22	165.41	174.00	670.00
Mercur	1.09	1.64	0.89	0.66	0.57	2.68	0.46	1.06	0.73	1.09	0.65	0.46	2.68
Rainfall (in	0.30	0.53	0.38	0.99	1.10	0.78	0.65	0.47	0.15	0.59	0.30	0.15	1.10

→ All units in ug/l

APPENDIX G

CHEVRON STATION FUEL LEAK

Chevron

Chevron U.S.A. Products Company
2410 Camino Ramon, San Ramon, California • Phone (510) 842-9500
Mail Address: P.O. Box 5004, San Ramon, CA 94583-0804

Operations

FEB 17 1993

38-[illegible]

February 16, 1993 FILE

San Francisco County Department of Health Services
101 - Grove Street
Room # 220
San Francisco, California 94102
Atten: Mr. Albert Lee

Re: Former Chevron Station #9-6235
3451 - 19th Avenue
San Francisco, California
SF LOP Site # 10018

Dear Mr. Lee:

In receival of your letter dated January 26, 1993, you had requested the submittal of the following items;

1.) Tank closure report and various quarterly groundwater monitoring reports. Enclosed are the requested reports for your review.

2.) Documentation of the removal of free product from monitoring well C-2. Enclosed is the documentation discussing the technology and process (passive skimmer) for the removal of the free product encountered in well C-2 since April of 1992 to current date, with bailing of the skimmer on a weekly basis. Previous to April of 1992, free product was hand bailed on a quarterly basis in conjunction with quarterly groundwater monitoring activities.

3.) Submittal of design and work plan to be used for soil and groundwater remediation system. Remedial options are currently being reviewed by our consultant, Weiss Associates. At this time soil vapor extraction is being considered for remedial activities. A work plan for a soil vapor pilot test should be submitted to your office by April 15, 1993.

4.) Submittal of estimated time of implementation of groundwater remediation. As discussed in item # 3 above, soil vapor extraction is being considered the more appropriate remedial activity for this site. Soil vapor extraction will be able to address any sources remaining in the soils vadose area and capillary fringe area, and the free product in well C-2 as well. Therefore, groundwater remediation is not being considered at this time.

5.) Soil Vapor Survey report. Enclosed is the Weiss Associates Subsurface Investigation Report - Phase II dated August 1988 which contains the information pertaining to the soil vapor survey activities conducted on site in May 1988.

I declare under penalty of perjury that the information contained in the attached report is true and correct, and that any recommended actions are appropriate under the circumstances, to the best of my knowledge. If you have any questions or comments, please feel free to contact to me at (510) 842-9103.

Sincerely,

Cynthia A. Wong

Cynthia Wong
Site Assessment & Remediation Engineer

cc: Mr. Vic Pal; Regional Water Quality Control Board; w/o encls.
Ms. Lori Casias; State Water Resources Control Board; w/o encls.
Bette Owen; Chevron Property Specialist; w/o encls.

(96235R1)

38 - U07C

FILE FEB 05 1993

Chevron

Chevron U.S.A. Products Company
2410 Camino Ramon, San Ramon, California • Phone (510) 842-9500
Mail Address: PO Box 5004, San Ramon, CA 94583-0804

Operations

February 3, 1993

San Francisco County Department of Health Services
101 - Grove Street
Room # 220
San Francisco, California 94102
Atten: Ms. Cherie D'Andrea

Re: Former Chevron Station #9-6235
3451 - 19th Avenue
San Francisco, California

Dear Ms. D'Andrea:

Enclosed is the quarterly groundwater monitoring report dated December 31, 1992 as prepared by our consultant Weiss Associates. Sampling was conducted on November 9, 1992. Currently there are nine wells located on-site, C-1 through C-4, C-9, MW-2, MW-3, MW-10, and MW-11. Wells C-2, C-3, MW-10, and MW-11 were sampled this event. Well C-2 contained about 0.58 feet of floating hydrocarbons. The TPH-G levels for wells C-3, MW-10, and MW-11 were 39,000, non-detect, and 230 ppb. Their benzene levels were 5,400, 0.9, and 41 ppb.

Chevron will continue to conduct quarterly groundwater monitoring at this site.

I declare under penalty of perjury that the information contained in the attached report is true and correct, and that any recommended actions are appropriate under the circumstances, to the best of my knowledge. If you have any questions or comments, please feel free to contact to me at (510) 842-9103.

Sincerely,

Cynthia Wong
Site Assessment & Remediation Engineer

cc: Mr. Vic Pal; Regional Water Quality Control Board
Bette Owen; Chevron Property Specialist; w/o encl.

(96235QR8)

Weiss Associates
5500 Shellmound Street, Emeryville, CA 94608-2411
Environmental and Geologic Services
Fax 510-547-5043 Phone 510-547-5420

December 31, 1992

Cynthia Wong
Chevron U.S.A. Products Company
P.O. Box 5004
San Ramon, CA 94583-0804

Re: Fourth Quarter 1992
Ground Water Monitoring Report
Former Chevron Service Station #9-6235
3451 19th Avenue
San Francisco, California
WA Job #4-335-91

Dear Ms. Wong:

As you requested, Weiss Associates (WA) is providing this Ground Water Monitoring Report for the site referenced above (Figure 1). WA sampled the ground water monitoring wells (Figure 2) on November 9, 1992, in accordance with the requirements and procedures of the California Regional Water Quality Control Board - San Francisco Bay Region and local regulatory agencies.

SAMPLING PROCEDURES

Prior to purging and sampling the wells, WA measured the depth to ground water in each well to the nearest 0.01 ft using an electronic sounder (Table 1). We also checked the wells for floating hydrocarbons. About 0.58 ft of floating hydrocarbons were measured in well C-2. Consequently, no ground water samples were collected from this well.

WA collected ground water samples for analysis from selected wells after purging at least 3 well-casing volumes of ground water from each well, or purging the well dry and allowing the water table to recover to at least 80% of its static level. Each sample was decanted from a dedicated bailer into the appropriate clean sample containers and delivered to a California-certified laboratory following proper sample preservation and chain-of-custody procedures.

A Division of AquaTierra Associates Incorporated

As per the approval of the City of San Francisco Department of Public Works, purged ground water was discharged into the sanitary sewer clean-out located south of the site[1].

MONITORING AND ANALYTIC RESULTS

The top-of-casing elevation, depth to ground water and ground water elevation for each well are presented in Table 1. The ground water flow direction and the ground water elevation contours are shown on Figure 2.

Current and historical ground water analytic results are summarized in Table 2. The water sample collection records, and the analytic report and chain-of-custody forms are included as Attachments A and B, respectively.

PROPOSED WORK SCHEDULE

The First Quarter 1993 ground water sampling is scheduled for February 1993. We will submit a report presenting the field and analytic data by April 1993.

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[1] City of San Francisco Department of Public Works, January 11, 1990, Letter from Steven C. Medbery, Division Engineer, to James W. Carmody, Weiss Associates Senior Project Manager, concerning purge water disposal into San Francisco's sewage system, p. 1.

We appreciate this opportunity to provide hydrogeologic consulting services to Chevron and trust that this submittal meets your needs. Please call if you have any questions regarding this report.

Sincerely,
Weiss Associates

Kristina Koltavary
Technical Assistant

REGISTERED GEOLOGIST
JAMES W. CARMODY
No. EG 1576
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

James W. Carmody, C.E.G.
Senior Project Hydrogeologist

KK/JWC:fcr

E:\ALL\CHEV\300\335QMDE2.WP

Attachments A - Water Sample Collection Records
B - Analytic Report and Chain-of-Custody Forms

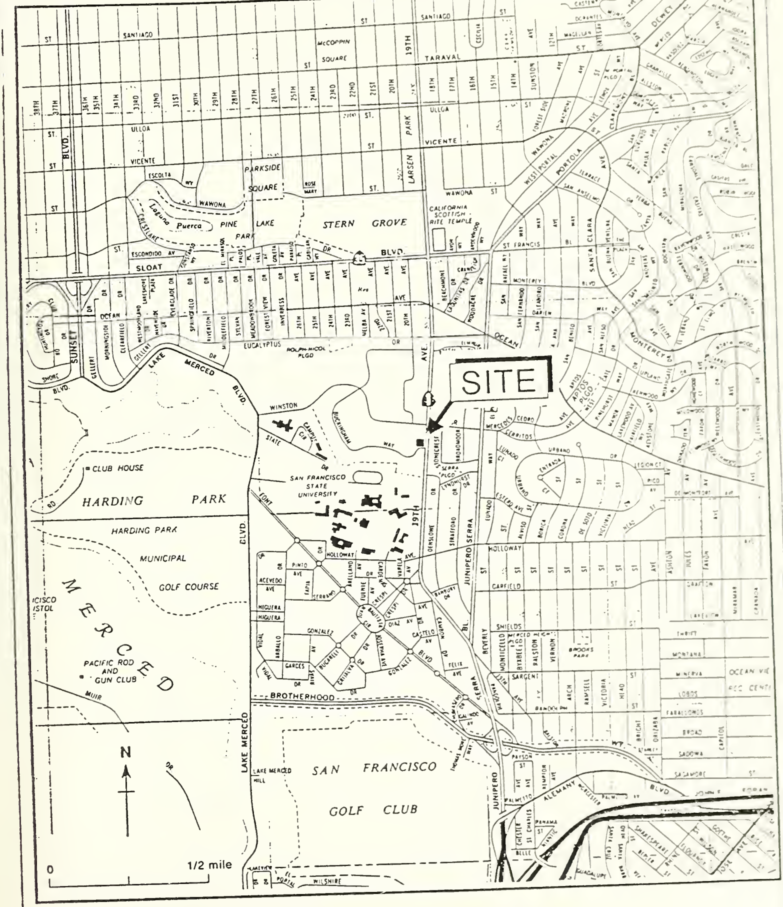

Figure 1. Site Location Map - Former Chevron Service Station #9-6235, 3451 19th Avenue, San Francisco, California

3-6-92

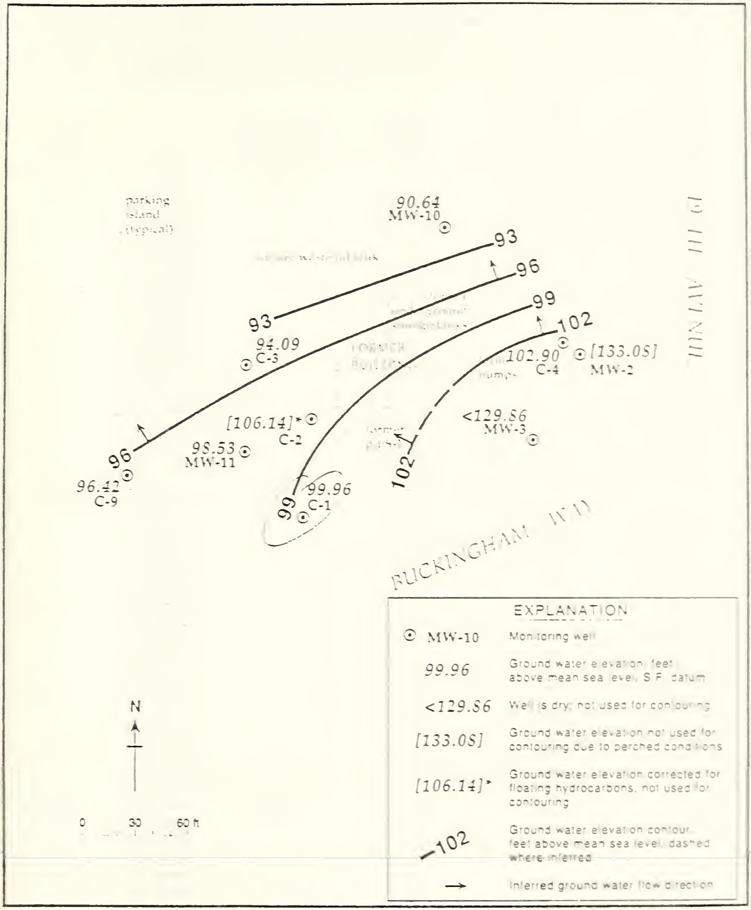
parking
island
(typical)
90.64
MW-10
93
93
96
96
99
99
102
102
94.09
C-3
FORMER
102.90
C-4
[133.08]
MW-2
pumps
[106.14]*
C-2
<129.86
MW-3
98.53
MW-11
96.42
C-9
99.96
C-1
19TH AVENUE
BUCKINGHAM WAY
N
0
30
60 ft
EXPLANATION
MW-10
Monitoring well
99.96
Ground water elevation, feet above mean sea level, S.F. datum
<129.86
Well is dry; not used for contouring
[133.08]
Ground water elevation not used for contouring due to perched conditions
[106.14]*
Ground water elevation corrected for floating hydrocarbons, not used for contouring
102
Ground water elevation contour, feet above mean sea level, dashed where inferred
Inferred ground water flow direction

Figure 2. Monitoring Well Locations and Ground Water Elevation Contours - November 9, 1992 - Former Chevron Service Station #9-6235, 3451 19th Avenue, San Francisco, California

Table 1. Ground Water Elevations, Former Chevron Service Station #9-6235, 3451 19th Avenue, San Francisco, California

Well ID	Date	Top-of-Casing Elevation (ft above msl)	Depth to Water (ft)	Thickness of Floating Hydrocarbons (ft)	Ground Water Elevation (ft above msl)
C-1	10-17-88	143.93	42.14	—	101.79
	01-20-89		43.59	—	100.34
	04-20-89		44.13	—	99.80
	08-09-89		44.32	—	99.61
	11-08-89		46.14	—	97.79
	01-23-90		46.72	—	97.21
	05-09-90		46.65	—	97.28
	08-08-90		46.86	—	97.07
	11-08-90		46.72	—	97.21
	02-15-91		46.49	—	97.44
	05-08-91		46.99	—	96.94
	08-07-91		46.81	—	97.12
	11-27-91		44.71	—	99.22
	02-14-92		44.34	—	99.59
	05-15-92		44.23	—	99.70
	08-10-92		44.19	—	99.74
	11-09-92		43.97	—	99.96
C-2	10-17-88	145.62	40.47	[a]	[b]
	01-20-89		41.88	2.20	105.50[c]
	04-20-89		44.21	3.66	104.34[c]
	08-09-89		43.88	3.36	104.43[c]
	11-08-89		43.24	3.72	105.36[c]
	01-23-90		40.53	0.38	105.39[c]
	05-09-90		40.37	3.06	107.70[c]
	08-08-90		43.34	2.78	104.50[c]
	11-08-90		43.41	3.32	104.87[c]
	02-15-91		43.32	2.67	104.44[c]
	05-08-91		43.47	1.40	103.27[c]
	08-07-91		43.69	1.47	103.11[c]
	11-27-91		43.14	1.30	103.52[c]
	02-14-92		43.77	1.49	103.04[c]
	05-15-92		44.46	0.37	101.46[c]
	08-10-92		41.39	0.62	104.73[c]
	11-09-92		39.94	0.58	106.14[c]
C-3	10-17-88	145.64	50.79	—	94.85
	01-20-89		52.52	—	93.12
	04-20-89		52.74	—	92.90
	08-09-89		52.60	—	93.04
	11-08-89		53.12	—	92.52
	01-23-90		53.26	—	92.38
	05-09-90		53.22	—	92.42
	08-08-90		53.36	—	92.28

— Table 1 continues on next page —

Table 1. Ground Water Elevations, Former Chevron Service Station #9-6235, 3451 19th Avenue, San Francisco, California (continued)

Well ID	Date	Top-of-Casing Elevation (ft above msl)	Depth to Water (ft)	Thickness of Floating Hydrocarbons (ft)	Ground Water Elevation (ft above msl)
	11-08-90		53.08	—	92.56
	02-15-91		52.88	—	92.76
	05-08-91		52.86	—	92.78
	08-07-91		52.71	—	92.93
	11-27-91		52.35	—	93.29
	02-14-92		51.91	—	93.73
	05-15-92		51.72	—	93.92
	08-10-92		51.77	—	93.87
	11-09-92		51.55	—	94.09
C-4	10-17-88	151.05	46.46	—	104.59
	01-20-89		46.90	—	104.15
	04-20-89		47.28	—	103.77
	08-09-89		47.53	—	103.52
	11-08-89		47.69	—	103.36
	01-23-90		47.90	—	103.15
	05-09-90		47.91	—	103.14
	08-08-90		48.08	—	102.97
	11-08-90		48.07	—	102.98
	02-15-91		48.04	—	103.01
	05-08-91		48.27	—	102.78
	08-07-91		48.43	—	102.62
	11-27-91		48.36	—	102.69
	02-14-92		48.32	—	102.73
	05-15-92		48.34	—	102.71
	08-10-92		48.22	—	102.83
	11-09-92		48.15	—	102.90
C-9	10-17-88	142.22	44.86	—	97.36
	01-20-89		45.63	—	96.59
	04-20-89		46.05	—	96.17
	08-09-89		46.10	—	96.12
	11-08-89		46.78	—	95.44
	01-23-90		46.52	—	95.70
	05-09-90		46.74	—	95.48
	08-08-90		46.79	—	95.43
	11-08-90		46.56	—	95.66
	02-15-91		46.53	—	95.69
	05-08-91		46.97	—	95.25
	08-07-91		47.20	—	95.02
	11-27-91		40.80	—	95.42
	02-14-92		46.68	—	95.54
	05-15-92		46.29	—	95.93

— Table 1 continues on next page —

Table 1. Ground Water Elevations, Former Chevron Service Station #9-6235, 3451 19th Avenue, San Francisco, California (continued)

Well ID	Date	Top-of-Casing Elevation (ft above msl)	Depth to Water (ft)	Thickness of Floating Hydrocarbons (ft)	Ground Water Elevation (ft above msl)
	08-10-92		46.12	—	96.10
	11-09-92		45.80		96.42
MW-2	10-17-88	151.06	12.95	—	138.11
	01-20-89		11.59	—	139.47
	04-20-89		8.90	—	142.16
	08-09-89		9.38	—	141.68
	11-08-89		11.00	—	140.06
	01-23-90		11.65	—	139.41
	05-09-90[d]		—	—	—
	08-08-90		10.98	—	140.08
	11-08-90		12.27	—	138.79
	02-15-91		11.50	—	139.56
	05-08-91		9.10	—	141.96
	08-07-91		12.16	—	138.90
	11-27-91		13.16	—	137.90
	02-14-92		8.22	—	142.84
	05-15-92		8.69	—	142.37
	08-10-92		>17.78	—	<133.28
	11-09-92		12.98		138.08
MW-3	10-17-88	149.86	>20.00	—	<129.86
	01-20-89		>20.00	—	<129.86
	04-20-89		18.95	—	130.91
	08-09-89		>20.00	—	<129.86
	11-08-89		>20.00	—	<129.86
	01-23-90		>20.00	—	<129.86
	05-09-90		>20.00	—	<129.86
	08-08-90		>20.00	—	<129.86
	11-08-90		>20.00	—	<129.86
	02-15-91		>20.00	—	<129.86
	05-08-91		>20.00	—	<129.86
	08-07-91		>20.00	—	<129.86
	11-27-91		>20.00	—	<129.86
	02-14-92		16.52	—	133.34
	05-15-92		19.16	—	130.70
	08-10-92		>20.00	—	<129.86
	11-09-92		>20.00		<129.86
MW-10	08-09-89	151.49	55.11	—	96.38
	11-08-89		58.35	—	93.14
	01-23-90		59.39	—	92.10
	05-09-90		59.71	—	91.78
	08-08-90		60.04	—	91.45

— Table 1 continues on next page —

Table 1. Ground Water Elevations, Former Chevron Service Station #9-6235, 3451 19th Avenue, San Francisco, California (continued)

Well ID	Date	Top-of-Casing Elevation (ft above msl)	Depth to Water (ft)	Thickness of Floating Hydrocarbons (ft)	Ground Water Elevation (ft above msl)
	11-08-90		60.14	—	91.35
	02-15-91		59.78	—	91.71
	05-08-91		59.92	—	91.57
	08-07-91		60.04	—	91.45
	11-27-91		60.32	—	91.17
	02-14-92		59.99	—	91.50
	05-15-92		60.79	—	90.70
	08-10-92		60.76	—	90.73
	11-09-92		60.85	—	90.64
MW-11	08-09-89	143.71	45.40	—	98.31
	11-08-89		46.15	—	97.56
	01-23-90		46.46	—	97.25
	05-09-90		46.27	—	97.44
	08-08-90		46.41	—	97.30
	11-08-90		46.36	—	97.35
	02-15-91		46.28	—	97.43
	05-08-91		46.57	—	97.14
	08-07-91		46.51	—	97.20
	11-27-91		45.76	—	97.95
	02-14-92		45.57	—	98.14
	05-15-92		45.36	—	98.35
	08-10-92		45.30	—	98.41
	11-09-92		45.18	—	98.53

Notes:

a = Hydrocarbon thickness not measured

b = Ground water elevation not calculated due to lack of product thickness data.

c = Ground water elevation corrected for floating hydrocarbon by the formula: corrected ground water elevation = top of casing elevation - depth to water + (0.8 x hydrocarbon thickness).

d = Water level not recorded because car was parked over well

Table 2. Analytic Results for Ground Water - Former Chevron Service Station #9-6235, 3451 19th Avenue, San Francisco, California

Sample ID and Sampling Frequency	Date	Depth to Water (ft)	Analytical Lab	TPH-G	B	E	T	X	VOCs	EDB
				<--------	--------	--------parts per billion (µg/L)	--------	--------	--------	-------->
C-1 (Annually, 1st Quarter)	05-31-88	---	B&C	<500	<0.5	<0.5	<0.5	<0.5	---	---
	10-17-88	42.14	CCAS	<50	<0.1	<1.0	<1.0	<1.0	<0.1	<0.1
	01-20-89	43.59	SPA	<1,000	<0.3	0.7	2.0	8.0	---	---
	04-20-89	44.13	SPA	<500	<0.5	<0.5	<0.5	<0.5	---	---
	08-10-89	44.32	SPA	<500	<0.5	<0.5	<0.5	<0.5	---	---
	11-08-89	46.14	SPA	<500	<5.0	<5.0	<5.0	<5.0	ND	---
	01-23-90	46.72	SPA	<500	<0.5	<0.5	<0.5	<0.5	---	---
	02-15-91	46.49	SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
	02-14-92	44.34	SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
C-2 (Quarterly)	05-31-88	---	B&C	69,000	30,000	2,500	28,000	15,000	---	---
	10-17-88[a]	40.47	---	---	---	---	---	---	---	---
	01-20-89[a]	41.88	---	---	---	---	---	---	---	---
	04-20-89[a]	44.21	---	---	---	---	---	---	---	---
	08-10-89[a]	43.88	---	---	---	---	---	---	---	---
	11-08-89[a]	43.24	---	---	---	---	---	---	---	---
	02-15-91[a]	43.32	---	---	---	---	---	---	---	---
	01-23-90[a]	40.53	---	---	---	---	---	---	---	---
	05-09-90[a]	40.37	---	---	---	---	---	---	---	---
	08-08-90[a]	43.34	---	---	---	---	---	---	---	---
	11-08-90[a]	43.41	---	---	---	---	---	---	---	---
	05-08-91[a]	43.47	---	---	---	---	---	---	---	---
	08-07-91[a]	43.69	---	---	---	---	---	---	---	---
	11-27-91[a]	43.14	---	---	---	---	---	---	---	---
	02-14-92[a]	43.77	---	---	---	---	---	---	---	---
	05-15-92[a]	44.46	---	---	---	---	---	---	---	---
	08-10-92[a]	41.39	---	---	---	---	---	---	---	---
	11-09-92[a]	39.94	---	---	---	---	---	---	---	---
C-3 (Quarterly)	05-31-88	---	B&C	<500	150	8.2	110	220	---	---
	10-17-88	50.79	CCAS	2,000	1,000	10	60	100	110	<10
	01-20-89	52.52	SPA	<1,000	1,700	7.0	40	0.3	---	---
	04-20-89	52.74	SPA	920	520	2.0	32	46	---	---
	08-10-89	52.60	SPA	3,200	530	<0.5	74	170	140[b]	---
	11-08-89	53.12	SPA	1,300	2,100	<50	95	150	---	---
	01-23-90	53.26	SPA	4,500	1,800	<3.0	150	390	---	---
	05-09-90	53.22	SPA	11,000	4,100	3.1	170	640	---	---
	08-08-90	53.36	SPA	4,400	2,200	4.0	140	240	---	---
	11-08-90	53.08	SPA	4,500	2,900	16	190	300	---	---
	02-15-91	52.88	SPA	14,000	7,500	76	240	1,100	---	---
	05-08-91	52.86	SPA	8,200	3,500	41	140	490	---	---
	08-07-91	52.71	SPA	13,000	4,100	120	390	780	---	---
	11-27-91	52.35	SPA	45,000	5,000	740	2,400	3,800	---	---
	02-14-92	51.91	SPA	45,000	5,000	840	2,900	4,100	---	---
	05-15-92	51.72	SPA	78,000	6,300	1,100	2,600	5,500	---	---

-- Table 2 continues on next page --

Table 2. Analytic Results for Ground Water - Former Chevron Service Station #9-6235, 3451 19th Avenue, San Francisco, California (continued)

Sample ID and Sampling Frequency	Date	Depth to Water (ft)	Analytical Lab	TPH-G	B	E	T	X	VOCs	EDB
				<------------	------------	parts per billion (µg/L)	------------	------------	------------	------------>
	08-10-92	51.77	SPA	40,000	6,600	680	1,400	2,800	---	---
	11-09-92	51.55	SPA	39,000	5,400	330	690	950	---	---
C-4 (Annually, 1st Quarter)	06-01-88	---	B&C	<500	11	<5.0	18	170	---	---
	10-17-88	46.46	CCAS	<500	14	<5.0	<5.0	<5.0	<5.0	<5.0
	01-20-89	46.90	SPA	<1,000	0.8	<0.3	<0.3	<0.3	---	---
	04-20-89	47.28	SPA	<500	<0.5	<0.5	<0.5	<0.5	---	---
	08-10-89	47.53	SPA	<500	<0.5	<0.5	<0.5	<0.5	---	---
	11-08-89	47.69	SPA	<500	<5.0	<5.0	<5.0	<5.0	39^c	---
	01-23-90	47.90	SPA	<500	<0.5	<0.5	<0.5	<0.5	---	---
	02-15-91	48.04	SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
	02-14-92	48.32	SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
C-9 (Annually, 1st Quarter)	06-30-88	---	B&C	<1,000	<0.5	<0.5	<0.5	<0.5	---	---
	10-19-88	44.86	CCAS	<50	13	<1.0	<1.0	<1.0	19	<0.1
	01-20-89	45.63	SPA	<1,000	2.0	<0.3	<0.3	<0.3	---	---
	04-20-89	46.05	SPA	<500	<0.5	<0.5	<0.5	<0.5	---	---
	08-10-89	46.10	SPA	<500	<0.5	<0.5	<0.5	<0.5	---	---
	11-08-89	46.78	SPA	<500	<5.0	<5.0	<5.0	<5.0	6^d	---
	01-23-90	46.52	SPA	<500	<0.5	<0.5	<0.5	<0.5	---	---
	02-15-91	46.53	SPA	<50	<0.5	<0.5	0.8	2.0	---	---
	02-14-92	46.68	SPA	<50	<0.5	<0.5	<0.5	0.5	---	---
MW-2 (Annually, 1st Quarter)	05-04-88	---	SEQ	<50	<0.5	---	<1.0	$<4^e$	---	---
	06-01-88	---	B&C	<500	11	<5.0	18	170	---	---
	10-19-88	12.95	CCAS	<50	<0.1	<1.0	<1.0	<1.0	<0.1	<0.1
	01-20-89	11.59	SPA	<1,000	<0.3	<0.3	<0.3	<0.3	---	---
	04-20-89	8.90	SPA	<500	<0.5	<0.5	<0.5	<0.5	---	---
	08-10-89	9.38	SPA	<500	<0.5	<0.5	<0.5	<0.5	---	---
	11-08-89	11.00	SPA	<500	<5.0	<5.0	<5.0	<5.0	<5.0	---
	01-23-90	11.65	SPA	<500	<0.5	<0.5	<0.5	<0.5	---	---
	02-15-91	11.50	SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
	02-14-92	8.22	SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
MW-3 (Quarterly)	05-04-88	---	SEQ	180	72	---	1.0	4.0^e	---	---
	10-19-88^f	>20.00	---	---	---	---	---	---	---	---
	01-20-89^f	>20.00	---	---	---	---	---	---	---	---
	04-20-89	18.95	SPA	<500	<0.5	<0.5	<0.5	<0.5	---	---
	08-10-89^f	>20.00	---	---	---	---	---	---	---	---
	11-08-89^f	>20.00	---	---	---	---	---	---	---	---
	01-23-90^f	>20.00	---	---	---	---	---	---	---	---
	05-09-90^f	>20.00	---	---	---	---	---	---	---	---
	08-08-90^f	>20.00	---	---	---	---	---	---	---	---
	11-08-90^f	>20.00	---	---	---	---	---	---	---	---

-- Table 2 continues on next page --

Table 2. Analytic Results for Ground Water - Former Chevron Service Station #9-6235, 3451 19th Avenue, San Francisco, California (continued)

Sample ID and Sampling Frequency	Date	Depth to Water (ft)	Analytical Lab	TPH-G	B	E	T	X	VOCs	EDB
				<------------parts per billion (µg/L)------------>						
	02-15-91^f	>20.00	---	---	---	---	---	---	---	---
	05-08-91^f	>20.00	---	---	---	---	---	---	---	---
	08-07-91^f	>20.00	---	---	---	---	---	---	---	---
	11-27-91^f	>20.00	---	---	---	---	---	---	---	---
	02-14-92	16.52	SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
	05-15-92	19.16	SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
	08-10-92	>20.00	---	---	---	---	---	---	---	---
	11-09-92	>20.00	---	---	---	---	---	---	---	---
MW-10 (Quarterly)	08-10-89	55.11	SPA	<500	<0.5	<0.5	<0.5	<0.5	---	---
	11-08-89	58.35	SPA	<500	<5.0	<5.0	<5.0	<5.0	ND	---
	01-23-90	59.39	SPA	<500	<0.5	<0.5	<0.5	<0.5	---	---
	05-09-90	59.71	SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
	08-08-90	60.04	SPA	<50	2.0	<0.5	<0.5	<0.5	---	---
	11-08-90	60.14	SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
	02-15-91	59.78	SPA	63	<0.5	<0.5	<0.5	<0.5	---	---
	05-08-91	59.92	SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
	08-07-91	60.04	SPA	<50	1.5	<0.5	<0.5	<0.5	---	---
	11-27-91	60.32	SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
	02-14-92	59.99	SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
	05-15-92	60.79	SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
	08-10-92	60.76	SPA	110	0.8	1.5	1.0	9.7	---	---
	11-09-92	60.85	SPA	<50	0.9	<0.5	0.6	2.0	---	---
MW-11 (Quarterly)	08-10-89	45.40	SPA	<500	2.0	<0.5	<0.5	<0.5	---	---
	11-08-89	46.15	SPA	1,100	530	<10	93	160	20^b	---
	01-23-90	46.46	SPA	3,200	900	<3.0	140	420	---	---
	05-09-90	46.27	SPA	5,800	2,100	1.8	57	470	---	---
	08-08-90	46.41	SPA	2,800	1,100	4.0	42	290	---	---
	11-08-90	46.36	SPA	3,000	1,900	11	31	350	---	---
	02-15-91	46.28	SPA	2,200	1,000	18	52	220	---	---
	05-08-91	46.57	SPA	3,300	1,500	25	52	280	---	---
	08-07-91	46.51	SPA	1,700	370	5.6	2.3	54	---	---
	11-27-91	45.76	SPA	2,000	850	24	3.4	140	---	---
	02-14-92	45.57	SPA	1,800	900	24	2.6	110	---	---
	05-15-92	45.36	SPA	2,200	430	22	16	74	---	---
	08-10-92	45.30	SPA	99	12	0.8	<0.5	3.4	---	---
	11-09-92	45.18	SPA	230	41	1.7	<0.5	2.0	---	---
Bailer Blank	10-19-88		CCAS	<50	<0.1	<1.0	<1.0	<1.0	<0.1	<0.1
	01-20-89		SPA	<1,000	<0.3	<0.3	<0.3	<0.3	---	---
	04-20-89		SPA	<500	<0.5	<0.5	<0.5	<0.5	---	---
	08-10-89		SPA	<500	<0.5	<0.5	<0.5	<0.5	---	---

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Table 2. Analytic Results for Ground Water - Former Chevron Service Station #9-6235, 3451 19th Avenue, San Francisco, California (continued)

Sample ID and Sampling Frequency	Date	Depth to Water (ft)	Analytical Lab	TPH-G	B	E	T	X	VOCs	EDB
				<--------	--------	parts per billion	(µg/L)	--------	--------	-------->
Trip Blank	10-19-88		CCAS	<50	<0.1	<1.0	<1.0	<1.0	<0.1	<0.1
	01-20-89		SPA	<1,000	<0.3	<0.3	<0.3	<0.3	---	---
	04-20-89		SPA	<500	<0.5	<0.5	<0.5	<0.5	---	---
	08-10-89		SPA	<500	<0.5	<0.5	<0.5	<0.5	---	---
	11-08-89		SPA	<500	<5.0	<5.0	<5.0	<5.0	<5.0	---
	01-23-90		SPA	<500	<0.5	<0.5	<0.5	<0.5	---	---
	05-09-90		SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
	08-08-90		SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
	11-08-90		SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
	02-15-91		SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
	05-08-91		SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
	08-07-91		SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
	11-27-91		SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
	02-14-92		SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
	05-15-92		SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
	08-10-92		SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
	11-09-92		SPA	<50	<0.5	<0.5	<0.5	<0.5	---	---
DTSC MCLs				NE	1.0	680	100^g	1,750	h	0.02

Abbreviations:

TPH-G = Total Petroleum Hydrocarbons as Gasoline by EPA Method 8015
B = Benzene by EPA Method 8020
E = Ethylbenzene by EPA Method 8020
T = Toluene by EPA Method 8020
X = Xylenes by EPA Method 8020
VOCs = Volatile Organic Compounds by EPA Method 8240
EDB = Ethylene dibromide by Method 524.2 Fuel Fingerprint Analysis - Total Fuel and Aromatic Volatile Hydrocarbons
ND = Volatile organics not detected with detection limits between 5 and 20 parts per billion (ppb)
--- = Not analyzed
DTSC MCLs = Department of Toxic Substances Control Maximum Contaminant Level for Drinking Water
NE = DTSC MCL for TPH-G not established
<n = Not detected at detection limits of n ppb

Analytical Laboratory:

B&C = Brown and Caldwell Analytical Laboratories, Emeryville, California
CCAS = Central Coast Analytical Services, San Luis Obispo, California
SPA = Superior Precision Analytical, Inc., San Francisco, California
SEQ = Sequoia Analytical Laboratory, Redwood City, California

Notes:

a = Well not sampled due to presence of floating hydrocarbons
b = concentration of 1,2-dichloroethane
c = 11 ppb acetone and 28 ppb carbon disulfide
d = concentration of carbon disulfide
e = SEQ reports ethylbenzene in combination with xylenes
f = Well not sampled because it was dry
g = DTSC Recommended Action Level for Drinking Water
h = DTSC MCL for 1,2 dichloroethane = 0.5 ppb

APPENDIX H

REGIONAL WATER QUALITY CONTROL BOARD 1986 WATER QUALITY OBJECTIVES AND JULY, 1992 PROPOSED AMENDMENTS

III. WATER QUALITY OBJECTIVES

INTRODUCTION

For each beneficial water use, water quality objectives have been determined. Such objectives describe the level of water quality which should exist. In establishing relevant objectives, consideration was given to the expected water uses, any adverse effects of not attaining the established objectives, the capability of controlling water quality to permit all expected uses, and the administrative and institutional aspects of water quality control. Water quality resulting from attainment of the established objectives should be sufficiently high to insure protection for all designated current and potential beneficial uses. The Board recognizes that too little information exists in some cases to establish definitive objectives, but the Board believes its conservative approach to setting objectives has been proper.

Water quality shall conform to the objectives contained herein. When uncontrollable water quality factors result in the degradation of water quality beyond the levels or limits established herein as water quality objectives, a case-by-case analysis will be made of the benefits and costs of preventing further degradation. In cases where this analysis indicates that beneficial uses will be adversely impacted by allowing further degradation, then controllable water quality factors shall not cause any further degradation of water quality. Controllable water quality factors are those actions, conditions, or circumstances resulting from man's activities that may influence the quality of the waters of the State and that may be reasonably controlled.

These water quality objectives are considered to be necessary to protect present and potential beneficial uses enumerated in Chapter II of this plan and to protect existing high quality waters of the State. These objectives will be achieved primarily through the establishment and enforcement of waste discharge requirements and through the implementation of this water quality control plan.

In setting waste discharge requirements the Regional Board will consider, among other things, the potential impact on beneficial uses within the area of influence of the discharge, the existing quality of receiving waters, and the appropriate water quality objectives. The Regional Board will make a finding as to the beneficial uses to be protected within the area of influence of the discharge and establish waste discharge requirements at levels necessary to meet water quality objectives in order to protect those uses.

In general, the objectives are intended to govern the concentration of pollutant constituents in the main water mass. The same objectives cannot be applied at or immediately adjacent to submerged effluent discharge structures. Zones of initial dilution within which higher concentrations can be tolerated will be allowed for such discharges.

For a submerged buoyant discharge, characteristic of most municipal and industrial wastes that are released from submerged outfalls, the momentum of the discharge and its initial buoyancy act together to produce turbulent mixing. Initial dilution in this case is completed when the diluting wastewater ceases to rise in the water column and first begins to spread horizontally.

For shallow water submerged discharges, surface discharges, and nonbuoyant discharges, characteristic of cooling water wastes and some individual discharges, turbulent mixing results primarily from the momentum of discharge. Initial dilution, in these cases, is considered to be completed when the momentum induced velocity of the discharge ceases to produce significant mixing of the waste, or the diluting plume reaches a fixed distance from the discharge to be specified by the Board, whichever results in the lower estimate for initial dilution.

Compliance with water quality objectives may be prohibitively expensive or technically impossible in some cases. The Regional Board will consider modification of specific water quality objectives as long as the discharger can demonstrate that existing beneficial uses will be protected and that such a modification will otherwise be consistent with the State's Policy with Respect to Maintaining High Quality of Waters in California. This exception clause properly indicates that the Board will conservatively compare benefits and costs in these cases because of the difficulty in quantifying beneficial uses. This approach is also discussed in Chapter IV under the section titled "Wet Weather Overflow".

The remainder of this chapter is divided into four sections: State Board Resolution 68-16, which applies to all waters of the Basin; Objectives for Ocean Waters; Objectives for Inland Surface Waters; and Objectives for Ground Water. Many of the objectives given below simply identify parameters of concern and state that these shall not be allowed in concentrations that cause nuisance conditions to exist or impair beneficial uses. For those parameters for which numerical objectives are specified, a rationale is provided.

STATE BOARD RESOLUTION 68-16

Whenever the existing quality of water is better than the quality of water established herein as objectives, such existing quality shall be maintained unless otherwise provided by State Water Resources Control Board Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California," including any revisions thereto. (A copy of this policy is included in Appendix A). It is commonly called Resolution 68-16 and applies to all waters of the Basin.

OBJECTIVES FOR OCEAN WATERS

The provisions of the State Board's "Water Quality Control Plan for Ocean Waters of California" (Ocean Plan), and "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California" (Thermal Plan) and any revision thereto shall apply to ocean waters. (Copies of these plans are included in Appendix A). The Ocean Plan objectives are similar if not identical to many of the objectives for inland surface waters.

OBJECTIVES FOR INLAND SURFACE WATERS

The following objectives apply to all inland surface waters, including enclosed bays and estuaries of the Region. This includes all surface waters of the Region except the Pacific Ocean.

Color

Waters shall be free of coloration that causes nuisance or adversely affects beneficial uses.

Tastes and Odors

Waters shall not contain taste or odor-producing substances in concentrations that impart undesirable tastes or odors to fish flesh or other edible products of aquatic origin, that cause nuisance, or that adversely affect beneficial uses.

Floating Material

Waters shall not contain floating material, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.

Suspended Material

Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.

Settleable Material

Waters shall not contain substances in concentrations that result in the deposition of material that cause nuisance or adversely affect beneficial uses.

Oil and Grease

Waters shall not contain oils, greases, waxes or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect beneficial uses.

Biostimulatory Substances

Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses. Chlorophyll *a* concentration in excess of 50 ug/l (microgram per liter) upstream from Carquinez Bridge and 25 ug/l in San

Pablo Bay and in Central and Lower San Francisco Bay will indicate a need for the investigation of the cause of those concentrations. Such investigations will not be necessary if the conditions are (1) of a limited areal extent, (2) associated with the entrapment zone, or (3) not adversely affecting beneficial uses. Lower concentrations of chlorophyll **a** may indicate a need for investigation depending on the affected receiving water and the beneficial uses thereof.

Sediment

The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.

Turbidity

Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases from normal background light penetration or turbidity relatable to waste discharge shall not be greater than 10 percent in areas of 10 Jackson Turbidity Units (JTU) or more.

pH

The pH shall not be depressed below 6.5 nor raised above 8.5. This encompasses the pH range usually found in waters within the Basin. Controllable water quality factors shall not cause changes greater than 0.5 units in normal ambient pH levels.

Dissolved Oxygen

For all tidal waters, the following objectives shall apply:

In the Bay downstream of Carquinez Bridge	5.0 mg/l minimum
Upstream of Carquinez Bridge	7.0 mg/l minimum

For nontidal waters, the following objectives shall apply:

Waters designated as cold water habitat	7.0 mg/l minimum
Waters designated as warm water habitat	5.0 mg/l minimum

The median dissolved oxygen concentration for any three consecutive months shall not be less than 80 percent of the dissolved oxygen content at saturation.

Dissolved oxygen is a general index of the state of the health of receiving waters. Although minimum concentrations of 5 mg/l and 7 mg/l are frequently used as objectives to protect fish life, higher concentrations are generally desirable to protect sensitive aquatic forms. In areas unaffected by waste discharges a level of about 85 percent of oxygen saturation exists. A three-month median objective of 80 percent of oxygen saturation allows for some degradation from this level, but still requires a consistently high oxygen content in the receiving water.

Bacteria

Table III-1 provides a summary of the bacterial water quality objectives and identifies the sources of those objectives.

Temperature

Temperature objectives for Enclosed Bays and Estuaries are as specified in the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays of California" including any revisions thereto. (A copy of this plan is included in Appendix A).

In addition, the following temperature objectives apply to surface waters:

The natural receiving water temperature of inland surface waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such alteration in temperature does not adversely affect beneficial uses.

The temperature of any cold or warm freshwater habitat shall not be increased by more than 5°F (2.8°C) above natural receiving water temperature.

Salinity

Controllable water quality factors shall not increase the total dissolved solids or salinity of waters of the State so as to adversely affect beneficial uses, particularly fish migration and estuarine habitat.

Toxicity

All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce other detrimental responses in aquatic organisms. Detrimental responses include, but are not limited to, decreased growth rate and decreased reproductive success of resident or indicator species and/or significant alterations in population or community ecology or receiving water biota. Other relevant biological measures will be considered by the Regional Board in evaluating compliance with this objective. Additionally, effects on human health due to bioconcentration will be considered. As a minimum, compliance will be evaluated using the bioassay requirements contained in Chapter IV.

TABLE III-1
WATER QUALITY OBJECTIVES FOR COLIFORM BACTERIA [a]

Beneficial Use	Fecal Coliform MPN/100 ml	Total Coliform MPN/100 ml
Water Contact Recreation	log mean <200 90 percentile <400	median <240 no sample >10,000
Shellfish Harvesting [c]	median ≤14 90 percentile ≤43	median ≤70 90 percentile ≤230 [b]
Non-Contact Water Recreation [d]	mean <2000 90 percentile ≤4000	— —
Municipal Supply		
surface water [e]	log mean <20	log mean <100
groundwater	—	median <2.2 [f]

Notes:

[a] Based on a minimum of five consecutive samples equally spaced over a 30-day period.

[b] Based on a five-tube decimal dilution test or 300 MPN/100 ml when a three tube decimal dilutiontest is used.

[c] Source: National Shellfish Sanitation Program.

[d] Source: Report of the Committee on Water Quality Criteria, National Technical Advisory Committee, 1968.

[e] Source: DOHS recommendation.

[f] Based on a seven-day median.

TABLE III-1A
EPA BACTERIOLOGICAL CRITERIA FOR WATER CONTACT RECREATION [1,2]
(in colonies per 100 ml)

	Fresh Water		Salt Water
	enterococci	E. coli	enterococci
Steady State (all areas)	33	126	35
Maximum			
(designed beach)	61	235	104
(moderately used area)	89	298	124
(lightly used area)	108	406	276
(infrequently used area)	151	576	500

Notes:

[1] The criteria were published in the Federal Register, Vol. 51, No. 45 / Friday, March 7, 1986 / 8012–8016. The Criteria are based on:

Cabelli, V.J. 1983. Health Effects Criteria for Marine Recreational Waters. U.S. Environmental Protection Agency. EPA 600/1-80-031. Cincinnati, Ohio.

Dufour, A.P. 1984. Health Effects Criteria for Fresh Recreational Waters. U.S. Environmental Protection Agency. EPA 600/1-84-004. Cincinnati, Ohio.

[2] The EPA criteria apply to water contact recreation only. The criteria provide for a level of protection based on the frequency of usage of a given water contact recreation area. The criteria may be employed in special studies within this Region to differentiate between pollution sources or to supplement the current coliform objectives for water contact recreation.

The health and life history characteristics of aquatic organisms in waters affected by controllable water quality factors shall not differ significantly from those for the same waters in areas unaffected by controllable water quality factors. Also, controllable water quality factors shall not cause a detrimental increase in concentrations of toxic substances found in bottom sediments or aquatic life. Objectives for some toxic pollutants in municipal and agricultural supply waters are given in Table III-2. Water quality objectives for selected toxic pollutants in surface waters are given in Tables III-2A and III-2B. Derivation of site-specific objectives for segments of the Bay-Delta estuarine system is desirable in some cases and should be performed using general methods described in *The Water Quality Standards Handbook,* U.S. EPA, 1983 and specific Regional Board guidance.

The South Bay below the Dumbarton Bridge is a unique, water quality limited, hydrodynamic and biological environment which merits continued special attention by the Board. Site specific water quality objectives are absolutely necessary in this area for two reasons. First, its unique hydrodynamic environment dramatically affects the environmental fate of pollutants. Second, potentially costly nonpoint source pollution control measures must be implemented to attain any objectives for this area. The costs of those measures must be factored into economic impact considerations by the Board in adopting any objectives for this area. Nowhere else in the Region will nonpoint source economic considerations have such an impact on the attainability of objectives. Therefore, for this area, the objectives contained in Tables III-2A and III-2B will be considered guidance only, and should be used as part of the basis for site specific objectives. Programs described in Chapter IV will be used to develop site specific objectives for it. Ambient conditions shall be maintained until site specific objectives are developed.

Based on the concerns raised in the Cooperative Striped Bass Study and other studies, water quality objectives for aromatic hydrocarbons are also needed. Regarding lighter aromatic hydrocarbons (monocyclic aromatic hydrocarbons or MAHs), the 1980 EPA water quality criteria documents for benzene, ethylbenzene, and toluene define the need for chronic toxicity data for these chemicals. In the Continuing Planning section of Chapter IV, the Board recommends that EPA determine an acute-to-chronic ratio for MAHs for application to acute toxicity data for resident species. Regarding heavier aromatic hydrocarbons (polynuclear aromatic hydrocarbons or PAHs), a water quality objective is included in Table III-2A. It is based on the 1980 EPA Water Quality Criteria Document.

Un-ionized Ammonia

The discharge of wastes shall not cause receiving waters to contain concentrations of un-ionized ammonia in excess of the following limits:

0.025 mg/l as N	Annual Median
0.16 mg/l as N Maximum	(Cental Bay and upstream)
0.4 mg/l as N Maximum	(Lower Bay and South Bay)

A method for determining the un-ionized ammonia concentration is included in Appendix B.

The intent of this objective is to protect against the chronic toxic effects of ammonia in the receiving waters. An ammonia objective is needed for the following reasons:

1. Ammonia (specifically un-ionized ammonia) is a demonstrated toxicant. Ammonia is generally accepted as one of the principal toxicants in municipal waste discharges. Some industries also discharge significant quantities of ammonia.
2. Exceptions to the effluent toxicity limitations in Chapter IV of the Plan allow for the discharge of ammonia in toxic amounts. In most instances, ammonia will be diluted or degraded to a non-toxic state fairly rapidly. However, this does not occur in all cases, the South Bay being a notable example. The ammonia limit is recommended in order to preclude any build up of ammonia in the receiving water.
3. A more stringent maximum objective is desirable for the northern reach of the Bay for the protection of the migratory corridor running through Central Bay, San Pablo Bay, and upstream reaches.

Sulfide

All water shall be free from dissolved sulfide concentrations above natural background levels. Sulfide occurs in Bay muds as a result of bacterial action on organic matter in an anaerobic environment.

Concentrations of only a few hundredths of a milligram per liter can cause a noticeable odor or be toxic to aquatic life. Violation of the sulfide objective will reflect violation of dissolved oxygen objectives as sulfides cannot exist to a significant degree in an oxygenated environment.

PETE WILSON, Governor

TE OF CALIFORNIA
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
N FRANCISCO BAY REGION
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AKLAND, CA 94612
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NOTICE OF PUBLIC HEARING AND WORKSHOP

NOTICE OF FILING

PROPOSED GROUND WATER AMENDMENT TO THE WATER QUALITY CONTROL PLAN, SAN FRANCISCO BAY REGION

2) K
3) DHA 9/22/92
4) File 14.1.0.4

NOTICE IS HEREBY GIVEN, that the California Regional Water Quality Control Board, San Francisco Bay Region (Regional Board), will hold a public hearing to receive testimony on the proposed amendments to the Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan) and to consider adoption of the proposed ground water amendment to the Basin Plan.

A workshop on the ground water amendment is scheduled for September 3, 1992 at the Regional Board offices, 2101 Webster Street, Suite 500, Oakland, California. This workshop is scheduled to start at 9:30 a.m.

The public hearing will be held on Wednesday, October 21, 1992 starting at 9:30 a.m., at the BART Board Room at 800 Madison Street, Oakland, California. The Board will consider adoption of the amendment following the close of the public hearing. Written responses to comments received by the Regional Board on or before October 6th will be available at the October 21, 1992 public hearing.

The attached ground water amendment includes minor changes to Chapter I., "Introduction." Significant changes are proposed to the following sections of the Basin Plan:

Chapter II. Beneficial Uses:
A revised section "Ground Waters" replaces the existing paragraphs on page II-5.

Chapter III. Water Quality Objectives:
Existing paragraphs on page III-12 are deleted and replaced with a revised section titled "Objectives for Ground Water".

Chapter IV. Implementation:
Existing paragraphs on pages IV-40 through IV-42 including "Solid and Hazardous Waste" and "Leaking Underground Tanks and Abandoned Sites." are replaced by a new section titled "Ground Water Protection and Management". The new section includes the following subsections:

- Application of Water Quality Objectives
- Regulation of Pollution Sources
- Cleanup of Polluted Sites
- Ground Water Protection Programs.

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Action on these amendments will be taken in accordance with a regulatory program exempt under Section 21080.5 of the Public Resource Code. The Basin Planning process has been certified as "functionally equivalent" the preparation of an Environmental Impact Report (EIR) or Negative Declaration for the purposed of complying with the California Environmental Quality Act (Title 14, California code of Regulation, Section 15251). This Notice serves as the Notice of Filing for compliance with section 21808.5 of the Public Resources Code. The functional equivalent document and environmental checklist is available for public review at the Regional Board's office during normal business hours.

Interested individuals and organizations are invited to attend the workshop and public hearing. At the public hearing, oral testimony will not be accepted on issues other than the topics identified in this notice. Oral commentators are encouraged to submit written copies of their comments in order to ensure the accuracy of the record. Written comments should be received by the Regional Board by October 6, 1992. Responses to all written comments received will be available at to the October 21, 1992 Regional Board meeting.

Copies of the proposed amendments and related materials are available at the Regional Board offices during normal business hours. Written inquiries should be directed to the Planning Unit, California Regional Water Quality Control Board at the above address. Telephone inquiries should be directed to Linda Spencer at (510) 464-1199 or Michael P. Carlin at (510) 464-1325.

DATED: 7/24/92

Steven R. Ritchie
Executive Officer

Implementation of Statewide Plans

I. Chapter III. Water Quality Objectives: Proposed Changes

A. 1. *Delete the last two paragraphs on page III-1.*

2. *Delete the last sentence of the first column on page III-2.*

B. ~~*Supplement*~~ *Replace Tables III-2A and III-2B with the attached Tables* ~~*objectives adopted in the statewide plans (attached)*~~.

~~C. *Change the heading of Table III-2A to read* "WATER QUALITY OBJECTIVES FOR TOXIC POLLUTANTS FOR MARINE SURFACE WATERS WITH SALINITIES GREATER THAN OR EQUAL TO 5 PARTS PER THOUSAND". *Change the heading of Table III-2B to read* "WATER QUALITY OBJECTIVES FOR TOXIC POLLUTANTS FOR FRESH SURFACE WATERS WITH SALINITIES LESS THAN 5 PARTS PER THOUSAND".~~

~~D~~C. *Replace last paragraph on p. III-3 under the heading "Toxicity" with the following:*

There shall be no acute toxicity in ambient waters, including mixing zones. Acute toxicity is defined as a median of less than ninety percent survival, and less than seventy percent survival, 10% of the time, of test organisms in undiluted test sample in a 96-hour static or continuous-flow test.

There shall be no chronic toxicity in ambient waters outside mixing zones. Chronic toxicity is a detrimental biological effect on growth rate, reproduction, fertilization success, larval development, population abundance, community composition, or any other relevant measure of the health of an organism, population, or community. Chronic toxicity generally results from exposures to pollutants exceeding 96 hours. However, chronic toxicity may also be detected through short-term exposure of critical life stages of organisms. This narrative objective is equivalent to a numerical objective of 1.0 TUc, as a daily average. A chronic toxicity unit is defined as 100/NOEL (No Observed Effect Level). The NOEL is the maximum percent test water that causes no observed effect on test organisms, as determined by critical life stage toxicity tests.

~~E~~D. *Remove the last sentence of the first paragraph on page III-5. Add the following language:*

The Regional Board intends to work towards the derivation of site-specific objectives for the Bay-Delta estuarine system. Copper, nickel, selenium, and mercury will be the highest priorities in this effort. Site specific objectives to be considered by the Regional Board shall be developed in accordance with the provisions in Chapter II, Section D or Appendix 3 of the California Enclosed Bays and Estuaries Plan (State Water Resources Control Board Resolution 91-33) and specific Regional Board guidance. The site specific objectives for selenium and mercury will take into account impacts to beneficial uses caused by bioaccumulation. A draft mercury objective will be circulated for public review by January 1993. Pending the adoption of site-specific objectives, the objectives in Tables III-2A and III-2B apply throughout the Region.

FE. *Delete the second paragraph on page III-5, concerning South San Francisco Bay, and the following paragraph concerning objectives for aromatic hydrocarbons.*

TABLE III-2B
WATER QUALITY OBJECTIVES FOR FRESH SURFACE WATERS WITH SALINITIES LESS THAN 5 PARTS PER THOUSAND

1. Water Quality Objectives for the Protection of Aquatic Life

Constituent	Unit	4-Day Average	Daily Average	1-Hour Average	Instantaneous Maximum
arsenic	ug/l	190	–	360	–
cadmium	ug/l	b	–	b	–
chlordane*	ng/l	–	4.3	–	–
chromium (VI)[a]	ug/l	11	–	16	--
copper	ug/l	c	–	c	--
cyanide	ug/L	5.2	–	22	–
DDT*	ng/l	–	1.0	--	–
dieldrin	ng/l	–	1.9	–	--
endosulfan*	ng/l	–	56	–	220
endrin*	ng/l	–	2.3	–	180
heptachlor	ng/l	–	3.8	–	–
hexachlorocyclohexane-gamma	ng/l	–	80	–	–
lead	ug/l	d	–	d	–
mercury	ug/l	–	–	2.4	–
nickel	ug/l	e	–	e	–
PCBs*	ng/l	–	14	–	--
pentachlorophenol	ug/l	h	–	h	–
selenium	ug/l	5.0	–	20	–
silver	ug/l	–	–	–	f
toxaphene	ng/l	0.2	–	730	–
tributyltin	ng/l	20[i]	40	–	60
zinc	ug/l	g	–	g	–

a = This objective may be met as total chromium.

b-g = Objectives for these metals are expressed by the following formulas, where H = ln (hardness) in mg/l as $CaCO^3$:

b = 4-DAY AVERAGE cadmium = $e^{0.7852H - 3.490}$; 1-HOUR AVERAGE cadmium = $e^{1.128H - 3.828}$. For example where where hardness is 50 mg/l, the 4-DAY AVERAGE cadmium = 0.66 ug/l and the 1-HOUR AVERAGE cadmium = 1.8 ug/l.
c = 4-DAY AVERAGE copper = $e^{0.8545H - 1.465}$; 1-HOUR AVERAGE copper = $e^{0.9422H - 1.464}$. For example where hardness is 50 mg/l, the 4-DAY AVERAGE copper = 6.5 ug/l and the 1-HOUR AVERAGE copper = 9.2 ug/l.
d = 4-DAY AVERAGE lead = $e^{1.273H - 4.705}$; 1-HOUR AVERAGE lead = $e^{1.273H - 1.460}$. For example where hardness is 50 mg/l, the 4-DAY AVERAGE lead = 1.3 ug/l and the 1-HOUR AVERAGE lead = 34 ug/l.
e = 4-DAY AVERAGE nickel = $e^{0.846H + 1.1645}$; 1-HOUR AVERAGE nickel = $e^{0.846H + 3.3612}$. For example where hardness is 50 mg/l, the 4-DAY AVERAGE nickel = 88 ug/l and the 1-HOUR AVERAGE nickel = 790 ug/l.
f = INSTANTANEOUS MAXIMUM silver = $e^{1.72H - 6.52}$. For example where hardness is 50 mg/l, the INSTANTANEOUS MAXIMUM silver = 1.2 ug/l.
g = 4-DAY AVERAGE zinc = $e^{0.8473H + 0.7614}$; 1-HOUR AVERAGE zinc = $e^{0.8473H + 0.8604}$. For example where hardness is 50 mg/l, the 4-DAY AVERAGE zinc = 59 ug/l and the 1-HOUR AVERAGE zinc = 65 ug/l.
h = The 4-DAY AVERAGE objective for pentachlorophenol is $e^{1.005pH - 5.290}$. This is 13 ug/l at pH = 7.8.
The 1-HOUR AVERAGE objective for pentachlorophenol is $e^{1.005pH - 4.830}$. This is 20 ug/l at pH = 7.8.

i = Six-Month Median.

TABLE III-2B (continued)

2. Water Quality Objectives for the Protection of Human Health.

	Existing or Potential Sources of Drinking Water		Other Waters	
Constituent	Unit	30-day Average	Unit	30-Day Average
Noncarcinogens				
cadmium	ug/l	10	–	–
4-chloro-3-methyl phenol	ug/l	3000**	–	–
chromium (VI)*	mg/l	0.05	–	–
copper	ug/l	1000.0**	--	--
1,2-dichloro benzene*	ug/l	2700	mg/l	18
1,3-dichloro benzene	ug/l	400	ug/l	2600
2-4-dichlorophenol	ug/l	0.30**	–	–
endosulfan*	ug/l	0.9	ug/l	2.0
endrin*	ug/l	0.8	ug/l	0.8
fluoranthene	ug/l	42	ug/l	42
lead	ug/l	50.0	–	–
mercury	ng/l	12	ng/l	12
nickel	mg/l	0.6	mg/l	4.6
phenol	ug/l	300**	–	–
selenium	ug/l	10	–	–
silver	mg/l	0.05	–	–
toluene	ug/l	10000	mg/l	300
zinc	mg/l	5.0**	–	–
Carcinogens				
aldrin	pg/l	130	pg/l	140
arsenic	ug/l	5.0	–	–
benzene	ug/l	0.34	ug/l	21
chlordane*	ng/l	0.08	pg/l	81
chloroform	ug/l	100	ug/l	480
DDT*	ng/l	0.59	pg/l	600
1,4-dichloro benzene	ug/l	9.9	ug/l	64
dichloromethane	ug/l	4.6	ug/l	1600
dieldrin	pg/l	140	pg/l	140
halomethanes*	ug/l	100	ug/l	480
heptachlor	ng/l	0.16	ng/l	0.17
heptachlor epoxide	ng/l	0.07	ng/l	0.07
hexachlorobenzene	ng/l	0.66	pg/l	690
hexachlorocyclohexane				
alpha	ng/l	3.9	ng/l	13
beta	ng/l	14	ng/l	46
gamma	ng/l	19	ng/l	62
PAHs*	ng/l	2.8	ng/l	31
PCBs*	pg/l	70	pg/l	70
pentachlorophenol	ug/l	0.28	ug/l	8.2
TCDD* equivalents	pg/l	0.013	pg/l	0.014
toxaphene	ng/l	0.67	pg/l	690
2,4,6-trichlorophenol	ug/l	0.34	ug/l	1.0

TABLE III-2B (continued)

a = This objective may be met as total chromium.

* = See Appendix 1 of the California Inland Surface Waters Plan for definition of terms
** = taste and/or odor-based objectives

mg/l = milligram(s) per liter; ug/l = microgram(s) per liter;
ng/l = nanogram(s) per liter; pg/l = picogram(s) per liter; '–' = Not applicable

APPENDIX I

COMMON AND SCIENTIFIC NAMES OF WILDLIFE

APPENDIX I

Common and Scientific Names of Wildlife

Species Observed or With Potential to Occur at Lake Merced, San Francisco:

Common Name	**Scientific Name**
Reptiles	
Southwestern pond turtle	Clemmys marmorata pallida
Western fence lizard	Sceloporus occidentalis
Northern alligator lizard	Gerrhonotus coeruleus
Rubber boa	Charina bottae
Ringneck snake	Diadophis punctatus
Racer	Coluber constrictor
Common garter snake	Thamnophis sirtalis
Birds	
Red-throated loon	Gavia stellata
Common loon	Gavia immer
Pied-billed grebe *	Podilymbus podiceps
Horned grebe	Podiceps auritus
Red-necked grebe	Podiceps grisegena
Eared grebe *	Podiceps nigricollis
Western grebe *	Aechmophorus occidentalis
California brown pelican *	Pelecanus occidentalis californicus
Double-crested cormorant *	Phalacrocorax auritus
Brandt's cormorant	Phalacrocorax penicillatus
American bittern	Botaurus lentiginosus
Least bittern	Ixobrychus exilis
Great blue heron *	Ardea herodias
Great egret *	Casmerodius albus
Snowy egret *	Egretta thula
Green-backed heron *	Butorides striatus
Black-crowned night-heron *	Nycticorax nycticorax
Canada goose	Branta canadensis
Aleutian Canada goose	Branta canadensis leucopareia
Mallard *	Anas platyrhynchos
Northern pintail	Anas acuta
Cinnamon teal	Anas cyanoptera
Northern shoveler	Anas clypeata
Gadwall	Anas strepera
American wigeon	Anas americana
Canvasback	Aythya valisineria
Redhead	Aythya americana

Appendix I (Continued)

Ring-necked duck	Aythya collaris
Greater scaup	Aythya marila
Lesser scaup	Aythya affinis
Surf scoter	Melanitta perspicillata
White-winged scoter	Melanitta fusca
Common goldeneye	Bucephala clangula
Bufflehead	Bucephala albeola
Red-breasted merganser	Mergus serrator
Ruddy duck *	Oxyura jamaicensis
Osprey	Pandion haliaetus
Sharp-shinned hawk	Accipiter striatus
Cooper's hawk	Accipiter cooperii
Red-shouldered hawk *	Buteo lineatus
Red-tailed hawk *	Buteo jamaicensis
American kestrel *	Falco sparverius
California quail	Callipepla california
Virginia rail	Rallus limicola
Sora	Porzana carolina
American coot *	Fulica americana
Black-bellied plover	Pluvialis squatarola
Semipalmated plover	Charadrius semipalmatus
Killdeer *	Charadrius vociferus
Greater yellowlegs	Tringa melanoleuca
Lesser yellowlegs	Tringa flavipes
Spotted sandpiper	Actitis macularia
Pectoral sandpiper	Calidris melanotos
Common snipe	Gallinago gallinago
Red-necked phalarope	Phalaropus lobatus
Red phalarope	Phalaropus fulicaria
Bonaparte's gull	Larus philadelphia
Heermann's gull *	Larus heermanni
Mew gully	Larus canus
Ring-billed gull	Larus delawarensis
California gull	Larus californicus
Herring gull	Larus argentatus
Thayer's gull	Larus thayeri
Western gull *	Larus occidentalis
Glaucous-winged gull	Larus glaucescens
Caspian tern	Sterna caspia
Elegant tern	Sterna elegans
Forster's tern	Sterna forsteri
Rock dove *	Columba livia

Appendix I (Continued)

Band-tailed pigeon	Columba fasciata
Mourning dove *	Zenaida macroura
Great horned owl	Bubo virginianus
Anna's hummingbird *	Calypte anna
Rufous hummingbird	Selasphorus rufus
Allen's hummingbird	Selasphorus sasin
Belted kingfisher *	Ceryle alcyon
Downy woodpecker	Picoides pubescens
Northern flicker	Colaptes auratus
Western wood-pewee *	Contopus sordidulus
Black phoebe *	Sayornis nigricans
Tree swallow	Tachycineta bicolor
Violet-green swallow	Tachycineta thalassina
Northern rough-winged swallow	Stelgidopteryx serripennis
Bank swallow	Riparia riparia
Cliff swallow	Hirundo pyrrhonota
Barn swallow	Hirundo rustica
Scrub jay *	Aphelocoma coerulescens
Chestnut-backed chickadee *	Parus rufescens
Bushtit	Psaltriparus minimus
Red-breasted nuthatch *	Sitta canadensis
Pygmy nuthatch	Sitta pygmaea
Brown creeper	Certhia americana
Bewick's wren	Thryomanes bewickii
Winter wren	Troglodytes troglodytes
Marsh wren *	Cistothorus palustris
Golden-crowned kinglet	Regulus satrapa
Ruby-crowned kinglet	Regulus calendula
Blue-gray gnatcatcher	Polioptila caerulea
Swainson's thrush	Catharus ustulatus
Hermit thrush	Catharus guttatus
American robin *	Turdus migratorius
Varied thrush	Ixoreus naevius
Northern mockingbird	Mimus polyglottos
American pipit	Anthus rubescens
Cedar waxwing	Bombycilla cedrorum
Loggerhead shrike	Lanius ludovicianus
European starling *	Sturnus vulgaris
Hutton's vireo	Vireo huttoni
Orange-crowned warbler	Vermivora celata
Nashville warbler	Vermivora ruficapilla
Yellow warbler *	Dendroica petechia

Appendix I (Continued)

Yellow-rumped warbler	Dendroica coronata
Hermit warbler	Dendroica occidentalis
Saltmarsh yellowthroat	Geothlypis trichas sinuosa
Wilson's warbler	Wilsonia pusilla
California towhee	Pipilo crissalis
Fox sparrow	Passerella iliaca
Song sparrow	Melospiza melodia
Lincoln's sparrow	Melospiza lincolnii
White-throated sparrow	Zonotrichia albicollis
Golden-crowned sparrow	Zonotrichia atricapilla
White-crowned sparrow *	Zonotrichia leucophrys
Dark-eyed junco *	Junco hyemalis
Red-winged blackbird *	Agelaius phoeniceus
Western meadowlark	Sturnella neglecta
Brewer's blackbird *	Euphagus cyanocephalus
Brown-headed cowbird *	Molothrus ater
Purple finch	Carpodacus purpureus
House finch *	Carpodacus mexicanus
Red crossbill	Loxia curvirostra
Pine siskin	Carduelis pinus
Lesser goldfinch	Carduelis psaltria
American goldfinch	Carduelis tristis
House sparrow *	Passer domesticus
Amphibians	
Pacific slender salamander	Batrachoseps pacificus
Arboreal salamander	Aneides lugubris
Western toad	Bufo boreas
Pacific treefrog	Hyla regilla
California red-legged frog	Rana aurora draytoni
Bullfrog	Rana catesbeiana
Mammals	
Virginia opossum	Didelphis virginiana
Desert cottontail	Sylvilagus audubonii
Black-tailed hare	Lepus californicus
California ground squirrel	Spermophilus beecheyi
Western gray squirrel	Sciurus griseus
Fox squirrel	Sciurus niger
Botta's pocket gopher	Thomomys bottae
Deer mouse	Peromyscus maniculatus
Muskrat	Ondatra zibethicus

Appendix I (Continued)

Black rat	Rattus rattus
House mouse	Mus musculus
Gray fox	Urocyon cinereoargenteus
Red fox	Vulpes vulpes
Long-tailed weasel	Mustela frenata

Note: Sources for species occurrences are Dan Murphy (birds and mammals) and Ed Ely and Sam McGinnis (mammals, amphibians, and reptiles).

* Species observed during September 1992 field survey.

APPENDIX J

LAKE MERCED PUBLIC MEETING
APRIL 26, 1993

APPENDIX J

DRAFT LAKE MERCED WATER RESOURCE STUDY

Summary of Comments Received from the Public Information Meeting

April 26, 1993

The Lake Merced Draft Water Resource Study Public Information Meeting was held Monday, April 26, 1993, at 7:00pm at the Recreation Center For the Handicapped, 207 Skyline Boulevard, San Francisco. The meeting was attended by over 30 people. SFWD staff and members of the Lake Merced Steering Committee were also present.

Kay Wilson of Public Affairs Management opened the meeting with introductions of key SFWD staff and Lake Merced Steering Committee members. Mickey Heo of the SFWD described the role of other agencies in the preparation of the Draft Lake Merced Water Resource Study. Eva Vanek of Geo/Resource Consultants, Inc. presented an overview of the study and summarized the results. Public comments and questions were taken and recorded as follows:

Verbal Comments (recorded on flip charts)

1. Agree with the need for the study.
2. Will connection between South Lake and Impound Lake be reopened?
3. Connection should be made between South Lake and Impound Lake.
4. What are economical ways to add water to the lake?
5. Stormwater will need to be treated before adding to Lake Merced.
6. Can the SF Fire Department use water directly from Lake Merced?

7. Will increasing water level also increase mosquito problems at the lake?

8. Need to provide bathrooms for the 200 fishermen using the lake each day. (Portable bathrooms were destroyed.)

9. Raising lake levels will flood tules.

10. Do local golf courses take water directly from the lake?

11. Adding 8 feet to the lake will flood the fishing beach at South Lake and recreational beach at Impound Lake.

12. New habitats have been created at South Lake and Impound Lake due to drought/low water levels. What will happen to these areas if lake levels are raised?

13. Water color in Impound Lake was "murky red" at one time -- was this due to a spill or low lake levels?

14. Does anyone (golf courses, etc.) pay to pump water?

15. If stormwater is diverted into the lake to raise water levels, will lake bottom act as a filter trapping toxins?

16. Stormwater may affect quality of Lake Merced water for emergency supply.

17. Poor water quality is affecting recreational uses (fishing, etc.). Water quality is very important for recreational uses.

18. Potential toxins in fish due to poor water quality.

19. May need to set up a system to filter toxins from the lake or from stormwater entering the lake.

20. Inform fishermen of poor water quality, potential toxins in fish, etc.

21. Anaerobic bacteria problem at Lake Merced.

22. Maintain water level and quality.

23. Maintain access to fishing beaches.

24. Water quality level is acceptable for most habitats/species, but not perfect.

25. Adding water will drown tules and re-open Children's Pier.

26. Prioritize habitat values as #1 use at the lake.

27. Need to identify species of plants, insects, amphibians, etc. at lake.

28. Would Army Corps of Engineers or California Coastal Commission need to issue a permit for this project?

29. The mandated lake level, 27 feet, is not being met currently - is that a problem?

30. Golden Gate Audubon: Don't change water level in lake during nesting season.

31. Cormorants can/can't see fish if water level is raised? Many fish which are caught have been preyed upon by cormorants (they have holes in their bodies).

32. Do golf courses currently pump from lake?

33. Can the rise in water level be regulated when a certain level is reached?

34. Would RWQCB standards be met if more bathrooms were provided and the water level was increased?

35. Pump station used to pump into South Lake - where did that water come from?

36. Problem with accumulation of trash between NE and NW Lakes -- hazardous for boaters and fishermen trying to get through.

37. A tule control plan to stop encroachment is needed.

38. If a quick fix is needed, can Lake Merced acquire water from other water departments that are "dumping water"?

39. Is lead shot still being used at the Gun Club? Does it affect water quality?

40. Do fish pick up lead shot from the lake bottom?

41. Who is the "bad guy" in terms of lake level decline?

42. Lake dropped 2 to 4 feet quickly (over a period of 2 weeks in 1989 or 1990) - why?

43. Wells in the area pump water legally.

44. Water level at the lake is going down again.

45. Don't wait to raise lake levels. San Francisco will need the water supply in event of a major earthquake.

46. Potential for pollution problem in the event of a major earthquake (salt water intrusion into the lake from potential cracks in the lake bottom and sides).

47. Did the Lake Merced Water Resource Study address Pine Lake? Doesn't this lake have similar problems?

48. Is the Pine Lake problem due to groundwater pumping also?

49. Thank you for keeping the public informed. Good meeting!

WRITTEN COMMENTS

Golden Gate Audubon Society

A CHAPTER OF THE NATIONAL AUDUBON SOCIETY
SERVING SAN FRANCISCO AND PARTS OF ALAMEDA AND CONTRA COSTA COUNTIES

2945 Ulloa St.
San Francisco. CA 94116
May 5. 1993

Eva Vanek
Geo/Resource Consultants. Inc.
505 Beach St.
San Francisco. Ca 94133

RE: Lake Merced Water Resource Study

Ms. Vanek:

The conservation committee of the Golden Gate Audubon Society met on May 3. and asked me to express their concern about the water resource study for Lake Merced. There were a number of areas of concern.

Our first concern is with the process under which this matter was presented to the public. We believe this matter must conform to CEQA guidelines for public notification. The availability of the draft at 425 Mason St. made it virtually impossible for us to obtain a copy of the document. The fact that the draft document was not mailed to concerned citizens and organizations denied us and other the opportunity to comment appropriately. The fact that the document was not available only at the April 26 public meeting further compounds this problem. We also believe that the abbreviated comment period falls far short of the comment period mandated by SEQUA. Our notice of the April 26 meeting was post marked on April 16. and the public comment period ended on May 3.

Therefore. we formally request that you mail us a copy of the Draft Lake Merced Water Resource Study for our review. Furthermore. we believe you would continue to be in violation of CEQA if you fail to make the document available to people who attended the April 26 meeting and to the general public.

A second concern expressed at the conservation committee meeting dealt with the issue of the changed biotic community at Lake Merced. Since the water level was allowed to drop significantly during the drought the lake's ecosystem seems to have undergone a substantial change. For example, Green-backed Herons and Red-winged Blackbirds have extended their breeding ranges to the lake during the drought years. New plants. including a willow not known to exist elsewhere in the city have taken advantage of the lake's new shoreline. The area of most obvious change is the southern impoundment. but other areas may have undergone similiar

AMERICANS COMMITTED TO CONSERVATION
2530 San Pablo Avenue, Suite G • Berkeley, California 94702 • (510) 843-2222

changes which have yet to be discovered. These cumulative changes at the lake indicate that flooding at this time may bring about significant and irrevocable environmental impacts.

Therefore we believe a full environmental assessment must accompany the plan to raise the lake's water level by 8 feet. Such an assessment might also help determine whether the use of water from different sources including ground water, treated Hetch-Hetchy water, stormwater runoff overflow would be appropriate for the lake's plants, wildlife and fish. The environmental assessement would also enable us to determine whether an Environmental Impact Report would be necessary. With the information availaible at this time is seems an EIR would be required under CEQA.

In addition we wish to repeat the concern that any eventual plan indicate that significant changes in water level should not occur during the nesting season.

We are also concerned that this proposal was made outside the context of a Master Plan for Lake Merced. The Golden Gate Audubon Society has a long standing position of urging city agencies to develop such a plan, and we believe establishment of water quality standards and water level standards should be part of that master plan.

A final procedural concern has to do with our understanding that neither the California Coastal Commission nor the U.S. Army Corps of Engineers have been notified of this plan. They should both have been appraised during the comment period.

In summary, we are deeply concerned about procedural aspects of this plan which we believe jeprodize the plan's eventual implementation regardless of its merits. Based on the information provided at the public meeting on April 26, we have substantive concerns which must be addressed and which may very well require the development of an EIR. Since we have not yet seen the document we are unable to comment on other matters which may be of concern.

We continue to look forward to working with you on this matter.

Very truly yours,

Daniel P. Murphy

Daniel P. Murphy
Conservation Committee

LAKE MERCED WATER RESOURCE STUDY

Public Information Meeting
April 26, 1993

COMMENT SHEET

Name: JAMES H CUNNIFF Representing: SELF
(Name of organization or agency)

Address: 686 22ND AVE City: SF Zip Code: 94121

I would like to make the following comments regarding the Lake Merced Water Resource Study:

(Please print) AT THE MEETING, I ASKED ABOUT THE LEAD SHOT STILL BEING DISCHARGED DIRECTLY INTO THE LAKE BY THE PACIFIC ROD AND GUN CLUB. YOU SAID THAT STUDIES HAD INDICATED THIS DIRECT DISCHARGE OF LEAD INTO THE LAKE WAS NOT A PROBLEM.

THE GUN CLUB DISCHARGES SEVERAL THOUSAND ROUNDS PER WEEK INTO THE LAKE. IN 52 WEEKS, THAT'S A LOT OF LEAD. IN TEN YEARS, THAT'S AN AWFUL LOT OF LEAD. IS THIS REALLY NOT A PROBLEM? DIRECTLY INTO A WATER SUPPLY?

YOUR CLAIM THAT SEVERAL TONS OF PARTICULATE LEAD PER YEAR IN A MUNICIPAL WATER SUPPLY IS NOT A PROBLEM SIMPLY MAKES NO SENSE TO ME.

I'D LIKE TO SEE THE STUDIES YOU MENTIONED.

Use reverse side for additional comments.

**PLEASE PLACE THIS
IN THE COMMENT BOX
TONIGHT OR MAIL IT
BY MAY 3, 1993 TO:**

Eva Vanek
Geo/Resource Consultants, Inc.
505 Beach Street
San Francisco, CA 94133

LAKE MERCED WATER RESOURCE STUDY

Public Information Meeting

April 26, 1993

COMMENT SHEET

Name: Martin F. Larkin

Representing: Tides End Community Association

(Name of organization or agency)

Address: P.O. Box 16224

City: S.F. CA

Zip Code: 94116

I would like to make the following comments regarding the Lake Merced Water Resource Study:

(Please print) I attended your meeting on Monday, April 26, 1993, and I was impressed with your presentation. I am aware your intent was to inform us of the importance of the water quality of the lake and of the future water quality due to a major (possible) earthquake.

I appreciate your acceptance of those of us using Lake Merced, in some cases, daily, for recreation, basicly fishing, then discussing the conditions of the world.

I would like to add, my wife, Frances Larkin, is the present president of TECA, and has been involved with the entire Waste Water Program for many years. She is very knowledgeable of water quality, organizations involved, and many personnel [illegible] the project.

At a gathering of approximately 30 fishermen at Lake Merced, I described to the best of my ability, your intent. Please accept our input from this (informal) meeting.

1. Identify impurities entering the lake now. (no bathroom facilities, Golf Courses).
2. Identify controlling individual making final decisions affecting Lake Merced.
3. Identify all all agencies and their input to this project.
4. Explain power of Audubon Society over agencies controlling the incrusion of "natural plant life.

Use reverse side for additional comments.

PLEASE PLACE THIS IN THE COMMENT BOX TONIGHT OR MAIL IT BY MAY 3, 1993 TO: ➡

Eva Vanek
Geo/Resource Consultants, Inc.
505 Beach Street
San Francisco, CA 94133

Tides End Community Association appreciates a ppreciates your study and is willing to a ssist in any manner.

Please keep our organization on your mailing list. We hope our input, now and in the future will contribute to your study.

Sincerely,

Martin F. Larkin, Lake Merced Committee Chairman

LAKE MERCED WATER RESOURCE STUDY

Public Information Meeting
April 26, 1993

COMMENT SHEET

Name: Robert Emerson **Representing:** ______ (Name of organization or agency)

Address: ______ **City:** ______ **Zip Code:** ______

I would like to make the following comments regarding the Lake Merced Water Resource Study:

(Please print)

I think this Meeting was
a waste Of time & after
dinner affair.

Use reverse side for additional comments.

**PLEASE PLACE THIS
IN THE COMMENT BOX
TONIGHT OR MAIL IT
BY MAY 3, 1993 TO:**

Eva Vanek
Geo/Resource Consultants, Inc.
505 Beach Street
San Francisco, CA 94133

LAKE MERCED HILL

168 Lake Merced Bvd.
San Francisco, CA
94132

May 5, 1993

Ms. Eva Vanek
Geo/Resource Consultants, Inc
505 Beach Street
San Francisco, CA 94133

Dear Ms. Vanek:

I am writing in behalf of the six hundred residents of Lake Merced Hill.

We were quite disturbed during the years of the draught to observe how the impound part of the Lake between the bridge and Lake Merced Blvd. dried up almost completely. We were told that water was too scarce to fill the impound.

Consequently, the fish and fowl that customarily dwelled in the impound either died or disappeared.

Now that the draught is over is it possible to refill the impound?

Thank you for your consideration.

Elizabeth Regan

Elizabeth Regan
President

1100 lake merced boulevard ▪ san francisco, california 94132

SIGN-IN SHEET

LAKE MERCED PUBLIC INFORMATION MEETING
Monday, April 26, 1993, 7:00pm

NAME	REPRESENTING (Name of organization or agency)	ADDRESS
Karen Craft	SF School of Windsurfing	2369 Bay St SF CA 94123
Jeff Craft	" " " " " "	2369 BAY ST " " " "
Steven S. Ou	Na Mea Wa'a Canoe club	768 Bounty Dr. #6805 Foster City 94140
Frances McNamara	—	118 Springfield Dr
Jennifer Hooker	SF School of Windsurfing	3251 Steiner St. SF 94123
JACK KRONERT	LAKE MERCED	315 COLON SF 94127
DAN CHAMPEAU	1360 9th Av #16	→
Paul Gaucher	SF School of Wind. 135 Gardenside #314	→
Betty June Glass	255 Buckingham Wy #703	←

SIGN-IN SHEET

LAKE MERCED PUBLIC INFORMATION MEETING
Monday, April 26, 1993, 7:00pm

NAME	REPRESENTING (Name of organization or agency)	ADDRESS
MARTIN LARKIN	TIDES END COMMUNITY ASSN	P.O. BOX 16224 - S.F CA 94118 4733 LINCOLN WAY S.F.CA 94122
BEN GALE	SF HEALTH/BEH	101 GROVE STREET, RM. #17 SF - CA 94102
Don Munakata	SF DPW	1680 Mission St SF, CA 94103
Debbie Whaley	CH2M Hill	1111 Broadway, Ste 1200 Oakland, CA 94607
Dan Madrid		47 PARK MANOR DR Daly City, CA 94015
Bruce H. Kelly	Lakeshore Acres Improvement Club	336 Country Club Dr San Francisco, Ca 94132
GERALD MARTINEZ	FISHING	55 WARD CT APT 1 DC CA 94015
TERRY PICCARDO	FISHING	614 GELLERT BLVD D.C. Ca. 94015
George Tainter	Resident	154 Lake Merced Hill

SIGN-IN SHEET

LAKE MERCED PUBLIC INFORMATION MEETING

Monday, April 26, 1993, 7:00pm

NAME	REPRESENTING (Name of organization or agency)	ADDRESS
Lawrence J. Nolan		364 San Benito Wy S.F. 94127
ROBERT EMERSON	CONCERNED FISHERMEN	700/ CALIF ST. #3rd SF. 94121
Philip D [illegible]	Construction Teamsters #216	2450 30th Ave SF Ca 94116
Robert Hechman	SFWD	1000 El Camino Millbrae
JERRY ZAGORITES	L.A.I.C	4750 OCEAN AVE 94132
J. Harris		639 Wallace ST. #5 94080
JAMES H. CUNNIFF		

SIGN-IN SHEET

LAKE MERCED PUBLIC INFORMATION MEETING

Monday, April 26, 1993, 7:00pm

NAME	REPRESENTING (Name of organization or agency)	ADDRESS
Hernan Latorre	SF School of Windsurfing	381 HalfMoon lane #113 Daly City 94015
Robert Bragg	Myself	595 John Muir Dr #509 San Francisco, CA 94132
Chris Senti	Lake Merced Boat & Fish co	#1 Harding Rd S.F CA 94132
Dan Murphy	Golden Gate Audubon Society	2945 Gellert Dr SF 94132
Phyllis Abad	homeowner	590 Gellert Dr. S.F. 94132

APPENDIX K

GROUNDWATER MODEL DOCUMENTATION

APPENDIX K

GROUNDWATER MODEL DOCUMENTATION

This appendix provides information which, together with the basic model descriptions presented in Chapter 4, documents the data and assumptions used in the groundwater flow model of the Lake Merced area. Results and conclusions derived from sensitivity analysis using alternative data and assumptions are also described under each subject heading.

MODEL CODE

The model used MODFLOW, a modular, three-dimensional, finite-difference code for groundwater flow developed by the U.S. Geological Survey (McDonald and Harbaugh 1988). Preprocessing and postprocessing of data sets were done using a variety of commercial software, including MODELCAD, from Geraghty and Miller; AUTOCAD, from Autodesk; SURFER, from Golden Software; and Lotus 1-2-3 from Lotus Development Corporation. Fortran programs were written to prepare transient data sets for recharge and pumpage.

GRID GEOMETRY

The model grid consists of three horizontal layers with 39 columns and 44 rows. A plan view of the grid was presented in Figure 4-1. The grid is 28,000 ft long (in the north-south direction), 24,700 ft wide, and rotated 9 degrees west of true north. The lower left (southwest) corner of the grid is 4,380 ft east and 15,801 ft north of a point located at 37o37'30" north latitude, 122o32'30" west longitude. The widths of individual rows and columns in the grid are listed in Table K-1.

AQUIFER CHARACTERISTICS

Hydraulic Conductivity, Thickness, and Transmissivity

General aquifer characteristics for each layer were presented in Figure 4-2. Layer 1, the uppermost layer, is unconfined. In reality, the dune sands and Colma Formation represented by this layer lap up the flanks of the bedrock hills and peaks that form the central highlands of San Francisco. Because the base of the aquifer slopes upward, the saturated thickness becomes smaller, which decreases the transmissivity and increases the slope of the water table. The relatively thin, steep fringe areas of layer 1 could be represented in the model by gradually increasing the base elevation of grid cells in that area. However, this increases the risk that those cells will go dry during the simulation and automatically be deleted from the active flow domain.

An alternative approach was used to simulate the steep slope of the water table in the hilly eastern part of the modeled area. Layer 1 was assumed to be horizontal, and the hydraulic conductivity was gradually decreased eastward until the slope of the water table approximately matched the measured slope. By retaining a greater aquifer thickness, this approach allows accurate simulation of transmissivity and the water table slope without the risk of having cells go dry during the simulation. In practice, it was found that decreasing the hydraulic conductivity in steps from 15 feet per day (ft/d) near Lake Merced and the western part of the modeled area to 0.5 ft/d at the highest fringes of the groundwater basin produced a reasonable water table slope.

The hydraulic conductivity assumed for the body of Lake Merced (4,000 ft/d) represented a compromise between lake flatness and simulation time. Higher values of conductivity resulted in a flatter simulated lake surface but greatly increased the simulation time because the large discontinuity in aquifer characteristics between lake cells and adjacent aquifer cells caused the iterative matrix solution to converge more slowly. At the selected value, the east end of North Lake is less than 2 ft higher than the south end of South Lake. This is considered reasonable, given the range of water levels and water-level fluctuations that occur in this system.

North and South Lakes were connected by several high-conductivity lake cells to mimic the low flow resistance of the open culvert that connects them.

The hydraulic conductivity of the sand berm between South and Impound Lakes was calibrated to a value of 60 ft/d to achieve a water-level difference between the lakes of 1.5 ft in 1990.

Layer 2 was flat, 50 ft thick, and homogeneous, as indicated in Figure 4-2. The vertical leakance of layer 2 was calibrated to a value of 0.0006 per day. For an assumed 50-foot-thick layer, this corresponds to a vertical hydraulic conductivity of 0.015 ft/d, which is about 9 times larger than the value estimated from the results of an aquifer test near the Oceanside Water Pollution Control Plant (CH2M-Hill 1989). The discrepancy could result from local variations in the continuity or permeability of the clay layer, uncertainties associated with model calibration and interpretation of test results, and real differences in effective leakance for widely different time periods (days versus decades). Leakance values ranging from about 0.0002 to 0.004 were tested during model calibration. Larger values tended to result in excessive declines in layer 1 water levels during 1949-1990. Small values tended to result in excessive decline in layer 3 water levels.

Layer 3 was assumed to have constant hydraulic conductivity but variable thickness. Thickness was assumed to increase westward from about 50 ft along the flanks of San Bruno Mountain and Mount Davidson to about 700 ft, which would place the effective base of the basin about 100-200 ft below the bottom of the deepest wells. This assumes that deeper strata (to a maximum bedrock depth of about 3,500 ft near Thornton Beach State Park) are hydraulically isolated from shallower strata by relatively impermeable clay layers. Thick clay strata were encountered in deep test holes drilled into the Merced Formation (Yates et al. 1990).

During model calibration, a hydraulic conductivity of about 4 ft/d was selected for layer 3. This resulted in transmissivities ranging from 320 ft2/d in thin areas to 2,400 ft2/d in thick areas. The hydraulic conductivity value is about half as large as the value estimated from an aquifer test near Lake Merced (CH2M-Hill 1989), and the transmissivity values were generally smaller than the range of 2,150 to 3,200 ft2/d used in the Applied Consultants model (Applied Consultants and C/REM 1991). It was found during calibration that larger transmissivity values caused the drawdown from the Daly City municipal wells to be distributed over too large an area, resulting in too much water-level decline during 1949-1990 at deep wells in the northern part of the modeled area and not enough drawdown at the municipal well. To a certain extent, the calibrated values may be nonunique, and a different combination of transmissivity, storage coefficient, and vertical leakance might achieve similar results.

Hydraulic conductivity, vertical leakance, and transmissivity values for each cell in each layer are listed in Table K-1.

Specific Yield and Storage Coefficients

Two transient simulations were used to calibrate specific yields (Sy) and storage coefficients (S). In addition to the simulation of the 1949-1990 period using annual time steps, a simulation was done of the 1981- 1990 time period using semi-annual time steps. The second simulation allowed seasonal variations in pumpage and recharge to be included in the model, thereby allowing more accurate calibration of relatively short-term (seasonal) storage characteristics of the groundwater system. Hydrographs of measured and simulated water levels at eight locations from the second simulation are shown in Figure K-1.

In general, it was found that seasonal fluctuations in water levels were at least as sensitive to the assumed seasonal distribution of pumpage and recharge as to the Sy or S. Initial estimates resulted in fluctuations that were too small in layer 1 and too large in layer 3. Decreasing the Sy of layer 1 increased the fluctuation amplitude but also created long-term trends that were too large. These difficulties were overcome by using an Sy of 0.12 in layer 1, an S of 0.05 in layer 2 and 0.002 in layer 3, and the seasonal distributions of pumpage and recharge listed in Table K-2. Simulation results were not very sensitive to the S values selected for layers 2 and 3.

The Sy of cells representing Lake Merced was decreased from 1.0 to 0.80 during model calibration to better match lake level fluctuations. This decrease was reasonable because the total area of lake cells was about 20% larger than actual lake area during the 1980s.

GROUNDWATER RECHARGE

Annual groundwater recharge during 1949-1990 was estimated using a computer program for soil moisture and urban water use accounting developed by the U.S. Geological Survey (Phillips et al. 1992). To simplify the calculations, annual rainfall was divided into six class intervals each spanning a 6-inch increment of annual rainfall. The program was run for each class interval, and the resulting estimates of recharge were assigned to individual years depending on the class interval of rainfall for that year. The program estimated recharge for 12 land use zones. Average annual recharge at existing levels of development (1971-1990) are given for each zone in Table K-3.

Based on historical increases in municipal pumpage, urbanization of the Daly City area was assumed to increase from 63% to 100% of its existing level between 1949 and 1965.

GROUNDWATER PUMPAGE

Pumpage for irrigation was also estimated using the soil moisture program, and average annual pumpage under existing conditions (1971-1990) is shown in Table K-3.

Total municipal pumpage is recorded for a few years during the 1949-1990 period, and interpolated values were used for intervening years. Simulation results indicated that the initial assumption that municipal pumpage was distributed among the nine municipal wells in proportion to their pumping rate capacities is probably incorrect. This assumption resulted in drawdowns near Daly City wells 8 through 11 that were too large and rapid, especially during the 1950s. Instead, pumpage was redistributed among existing wells in each year such that simulated water levels more closely matched measured water levels. The amount of pumpage shifted was not large, and results were greatly improved. Water levels in the vicinity of each cluster of municipal wells were quite sensitive to pumpage at those wells.

Annual pumpage at municipal and irrigation wells during 1949-1990 is shown in Table K-4.

OCEAN BOUNDARY

The ocean boundary is represented in the model as head-dependent boundary cells throughout the offshore area of layer 1 and along the westernmost grid column of layers 2 and 3. The boundary heads for layers 1, 2, and 3 are 1.0, 3.1, and 9.5 ft, respectively, which correspond to the equivalent freshwater head for seawater at a depth equal to the vertical midpoint elevation of each layer. A uniform boundary leakance of 0.5 per day was multiplied by the cross-sectional area of each boundary cell to obtain the boundary conductance for each cell. The leakance represents the degree of hydraulic connection between the aquifer and the ocean. In this case, as in most cases, measured values were unavailable, and the value used in the model was obtained by calibration. Tripling the estimated leakance to 1.5 per day had almost no effect on simulated water levels or budgets. Typically, model results are insensitive to the boundary leakance unless it is small enough that it constrains groundwater flow more than does the transmissivity of the aquifer.

The model was also used to test the hypothes nnis that the Daly City area is protected from seawater intrusion by the dip of the Merced Formation. In the southwestern onshore part of the modeled area, the Merced Formation is folded such that strata dip toward the northeast at angles of 40o to 60o. The amount of folding decreases northward, and dips are less than 10o near Lake Merced. Clay layers that lie below the bottoms of wells in Daly City and the cemeteries might bend upward and intersect the land surface between the wells and the ocean. Thus, these upturned layers could form a bowl or trough that prevents seawater from moving toward the wells even though water levels at the wells are over 100 ft below sea level.

If this hypothesis is true, much of the area west of the Daly City-cemetery area would effectively be outside the flow domain affected by the wells, or at least would have a very low transmissivity. This would have the effect of increasing the amount of long-term water- level decline at wells in the Daly City-cemetery area. Simulated water level declines at the Olympic Club wells and the westernmost Daly City municipal wells provided some support for this hypothesis. When no trough or boundary effect was assumed, simulated long- term water level declines at these wells were too small. These wells would be closest to the western boundary of the trough, if it exists, and would be most likely to be affected by it.

To test an extreme version of the hypothesis, all cells in the southwestern corner of the grid were omitted from the active flow domain. The deactivated area extended north to about the southern end of South Lake and east to a line approximately 2,000 ft west of the line of wells along the valley axis. This caused simulated water levels to decline much more rapidly and continue declining throughout the simulation period rather than level off slightly in the 1970s and 1980s, as shown for selected wells in Figure K-2. A more moderate version was also tested in which transmissivity in the southwestern part of layer 3 was decreased by a factor of 5. Again, long-term water level declines at most wells in the southern part of the modeled area were too large and did not level off enough toward the end of the simulation. These results do not rule out the possibility that a zone of low transmissivity exists between the Daly City wells and the ocean. If other variables were simultaneously adjusted, it might be possible to recalibrate the model to include this assumption.

SIMULATION RESULTS

Figures K-3 through K-14 show simulated water levels in South Lake, Impound Lake, and six wells in the modeled area for various simulations discussed in Chapters 4 and 7.

APPENDIX K

TABLES

Table K-1. . . . . .K-1

Table K-1. . . . . .K-3

Table K-2. . . . . .K-3

Table K-3. . . . . .K-4

Table K-3. . . . . .K-4

Table K-4. . . . . .K-4

FIGURES

Figure 4-1 . . . . .K-1

Figure 4-2 . . . . .K-1

Figure 4-2 . . . . .K-2

Figure K-1 . . . . .K-3

Figure K-2 . . . . .K-5

Figures K-3 through K-14 .K-5

Acros.

feet per day (ft/d). K-2

specific yields (SY) K-3

storage coefficients (S) .K-3

REFERENCES

McDonald and Harbaugh 1988 . . . . .K-1

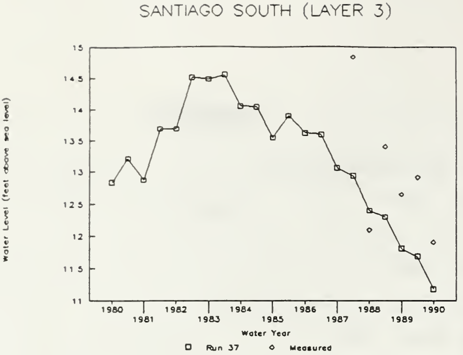
CH2M-Hill, 1989. . . . . .K-2

Yates et al. 1990. . . . . .K-3

CH2M-Hill, 1989. . . . . .K-3

Applied Consultants and C/REM 1991 . . . . .K-3

Phillips et al. 1992 . . . . .K-4



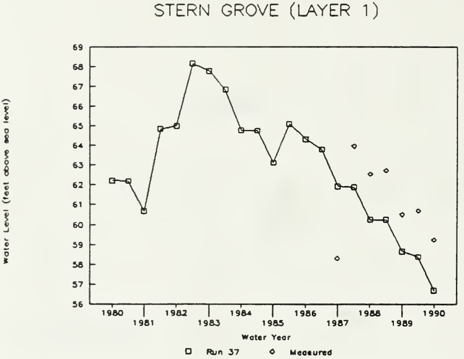
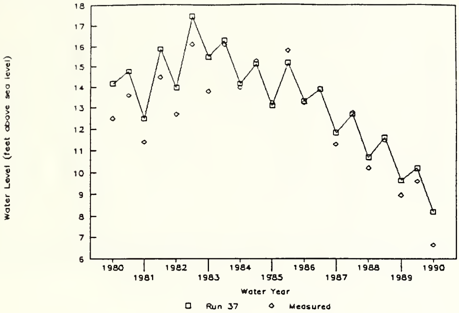


Figure K-1. Simulated water levels during 1981-1990 using semiannual time steps.

SOUTH LAKE



IMPOUND LAKE

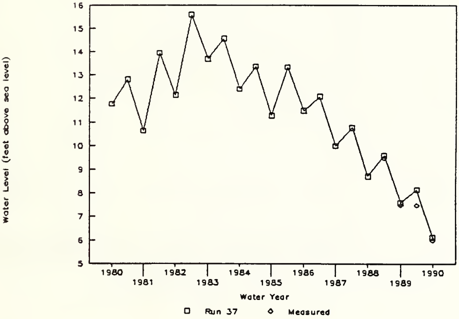
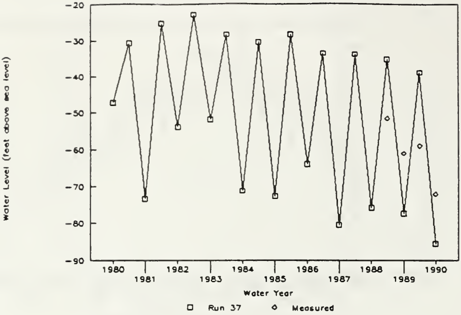
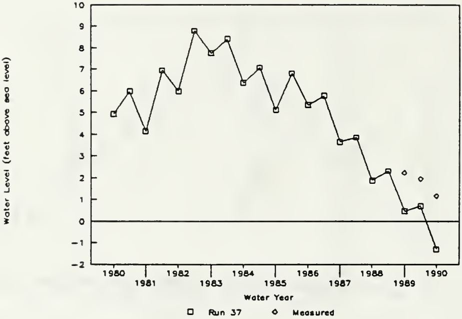


Figure K-1, continued.

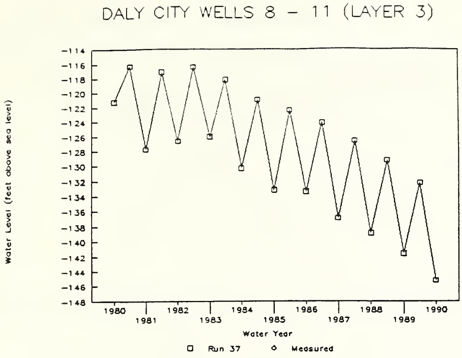


SF GOLF CLUB WEST (LAYER 3)

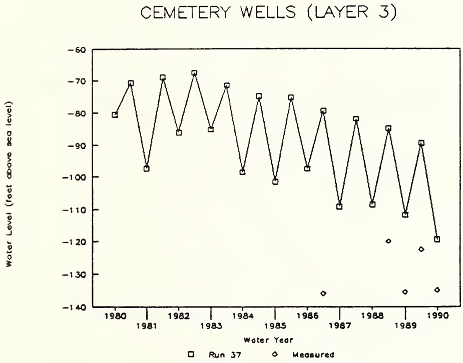


SF GOLF CLUB – USGS (LAYER 1)

Figure K-1, continued.



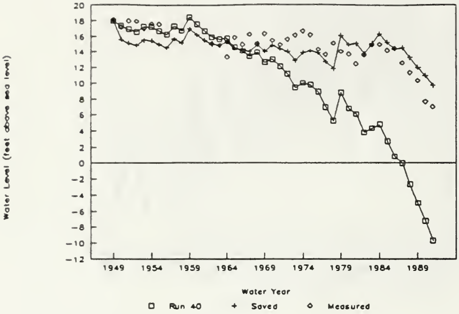
DALY CITY WELLS 8 – 11 (LAYER 3)



CEMETERY WELLS (LAYER 3)

Figure K-1, continued.

SOUTH LAKE



DALY CITY WELLS 1 & 2 (LAYER 3)

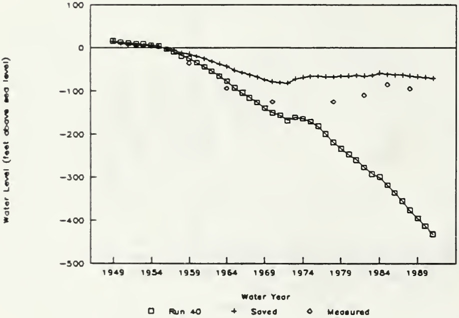
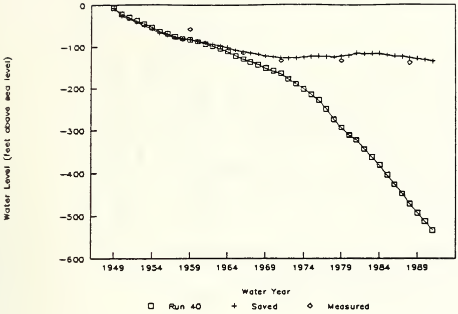
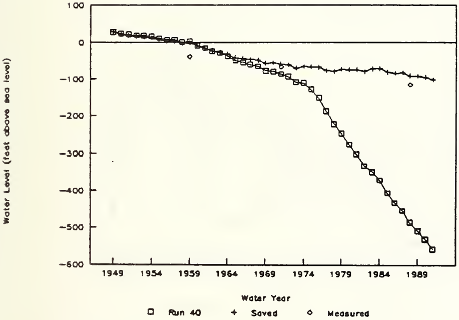


Figure K-2. Simulated water levels during 1949-1990 with the southwestern corner of the flow domain assumed to be impermeable.



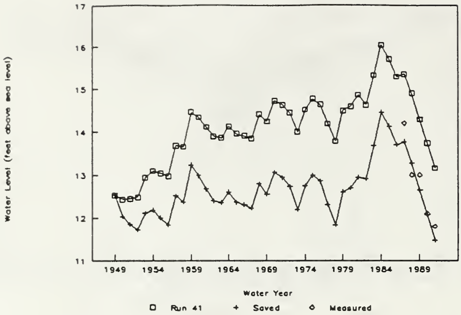
DALY CITY WELLS 8 – 11 (LAYER 3)



CEMETERY WELLS (LAYER 3)

Figure K-2, continued.

SANTIAGO SOUTH (LAYER 3)



STERN GROVE (LAYER 1)

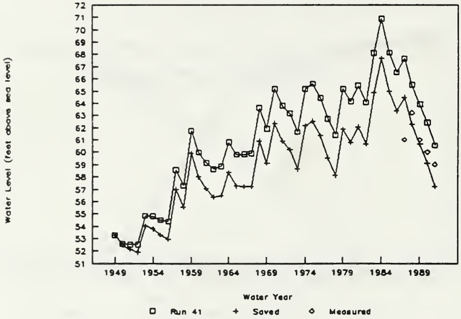


Figure K-3. Simulated water levels during 1949-1990 with and without pumping by golf course wells.

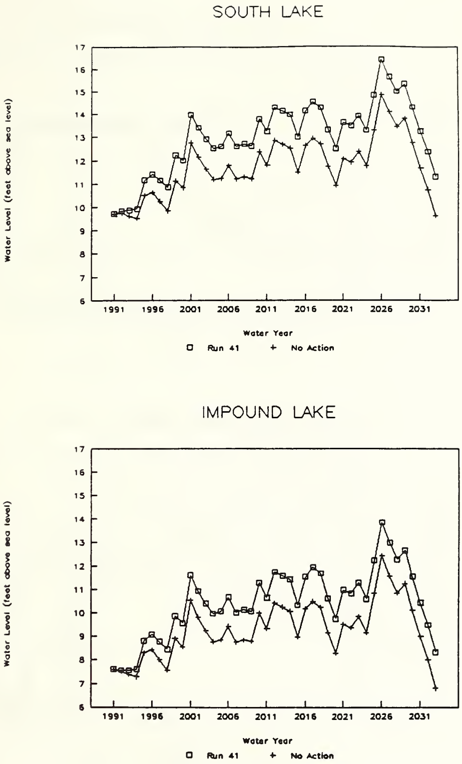
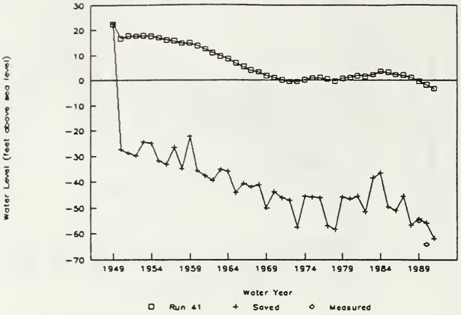


Figure K-3, continued.

SF GOLF CLUB WEST (LAYER 3)



SF GOLF CLUB – USGS (LAYER 1)

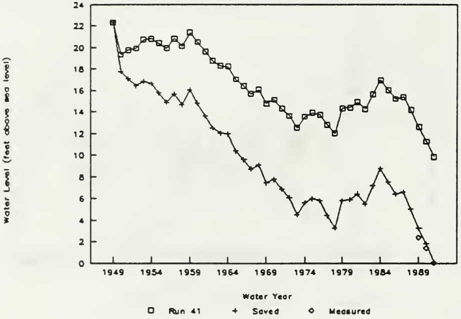
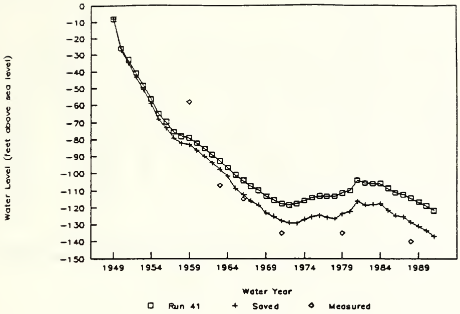


Figure K-3, continued.

DALY CITY WELLS 8 – 11 (LAYER 3)



CEMETERY WELLS (LAYER 3)

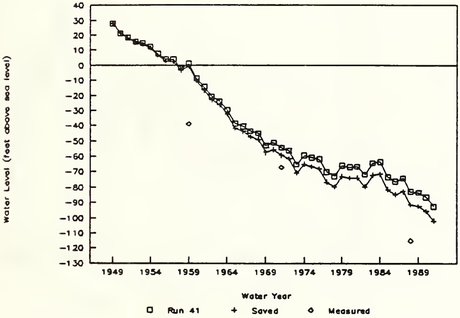
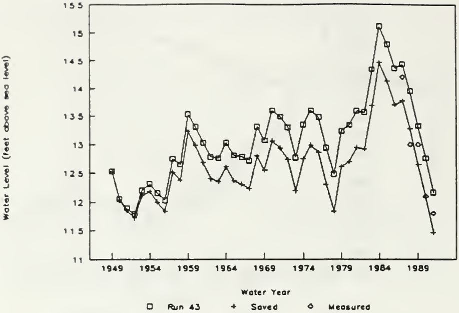


Figure K-3, continued.

SANTIAGO SOUTH (LAYER 3)



STERN GROVE (LAYER 1)

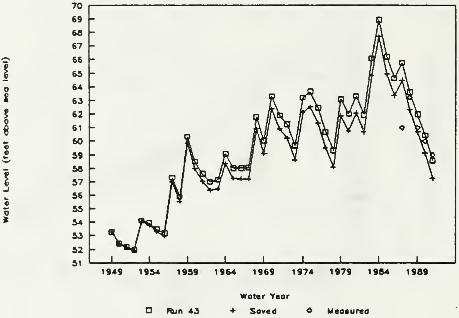
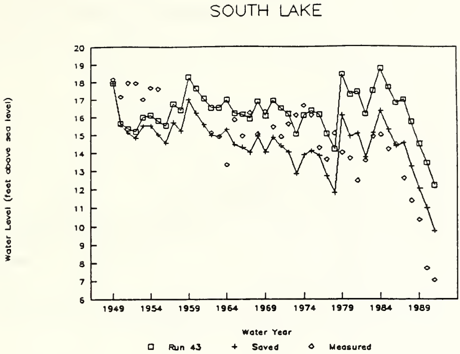


Figure K-4. Simulated water levels during 1949-1990 with no municipal pumping in Daly City.



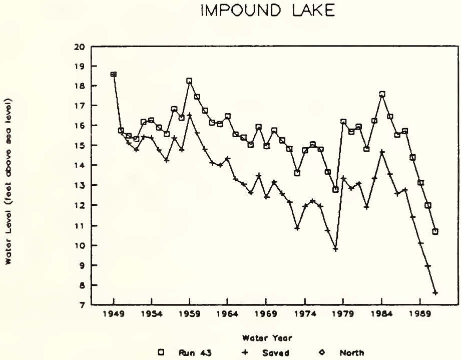
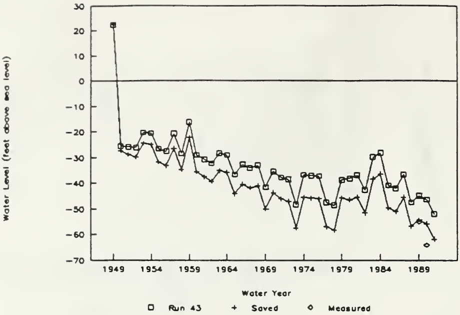
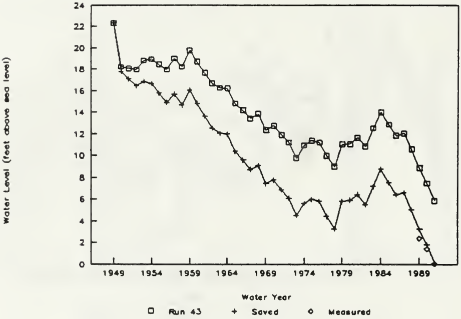


Figure K-4, continued.

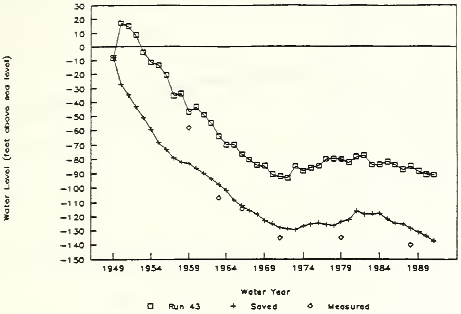


SF GOLF CLUB WEST (LAYER 3)

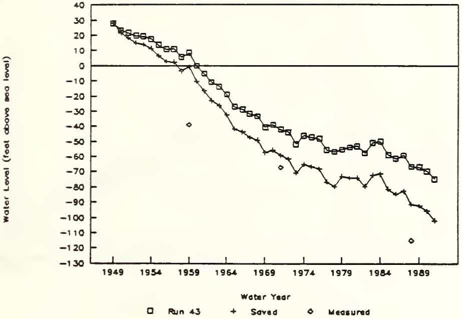


SF GOLF CLUB – USGS (LAYER 1)

Figure K-4, continued.



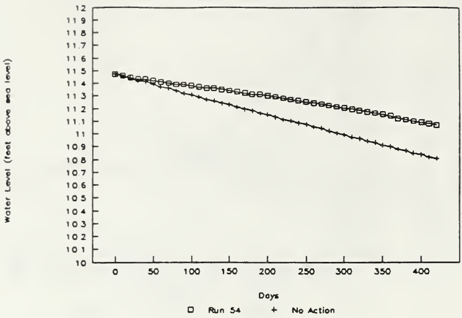
DALY CITY WELLS 8 – 11 (LAYER 3)



CEMETERY WELLS (LAYER 3)

Figure K-4, continued.

SANTIAGO SOUTH (LAYER 3)



STERN GROVE (LAYER 1)

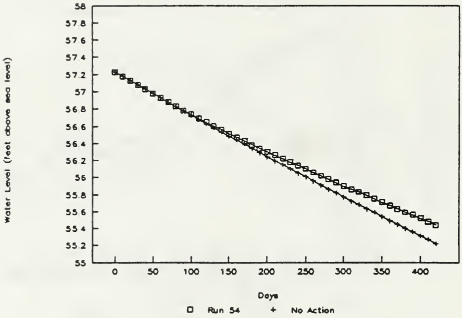
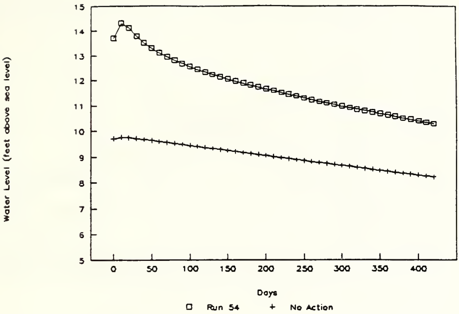
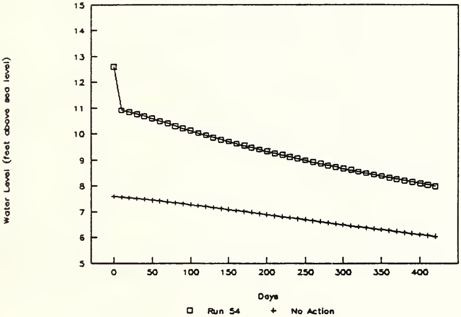


Figure K-5. Simulated effects of a sudden 4-foot increase in the level of Lake Merced on water levels in the groundwater system.



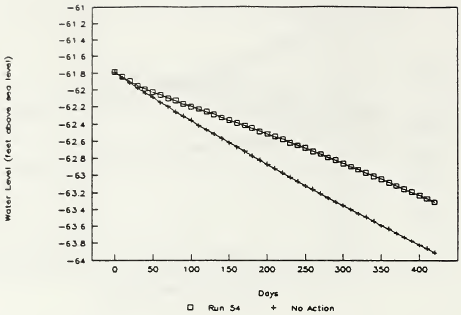
SOUTH LAKE



IMPOUND LAKE

Figure K-5, continued.

SF GOLF CLUB WEST (LAYER 3)



SF GOLF CLUB – USGS (LAYER 1)

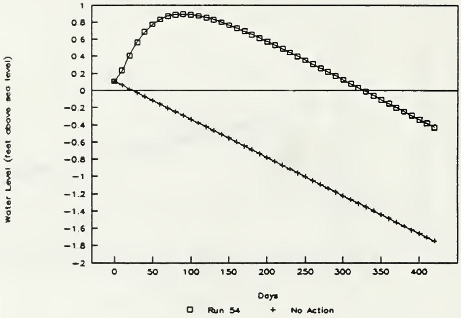
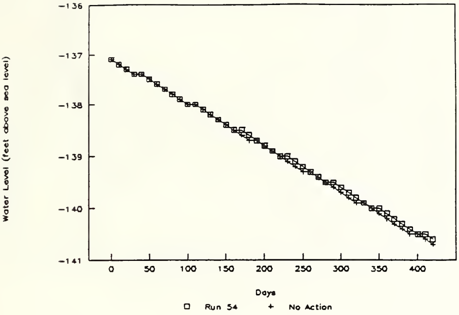


Figure K-5, continued.


DALY CITY WELLS 8 – 11 (LAYER 3)

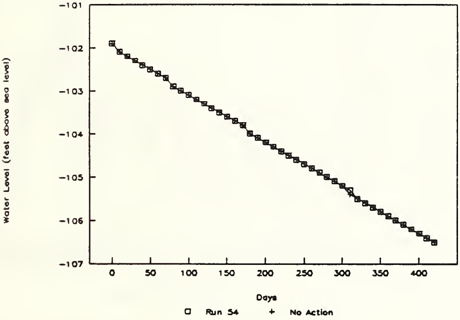
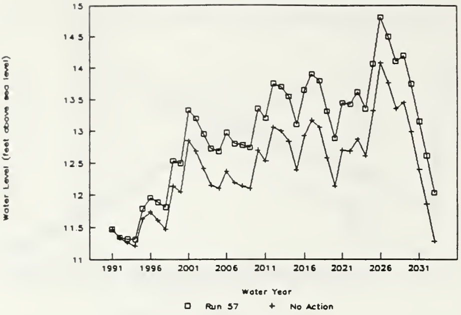

CEMETERY WELLS (LAYER 3)

Figure K-5, continued.

SANTIAGO SOUTH (LAYER 3)



STERN GROVE (LAYER 1)

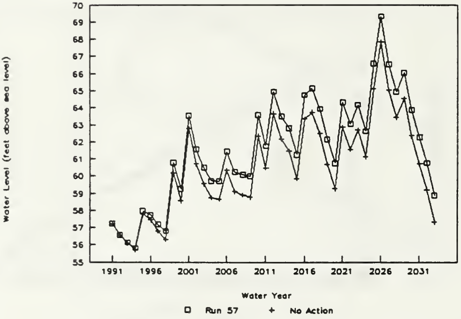
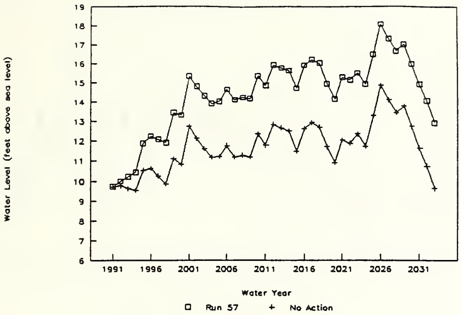
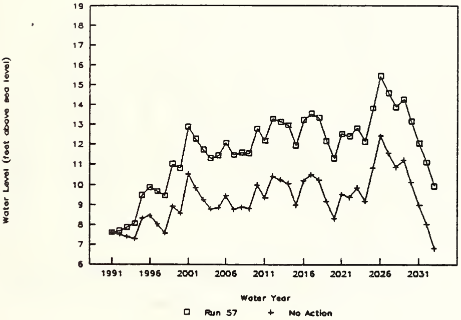


Figure K-6. Simulated water levels during 1991-2032 with 100 Mgal per year added to Lake Merced from an external source.

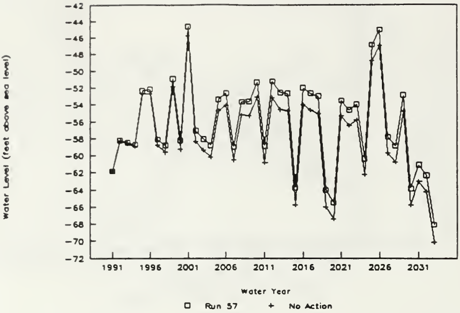


SOUTH LAKE



IMPOUND LAKE

Figure K-6, continued.


SF GOLF CLUB WEST (LAYER 3)

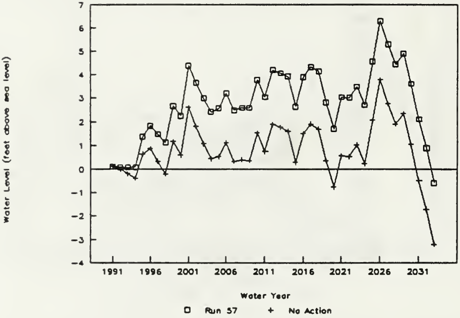
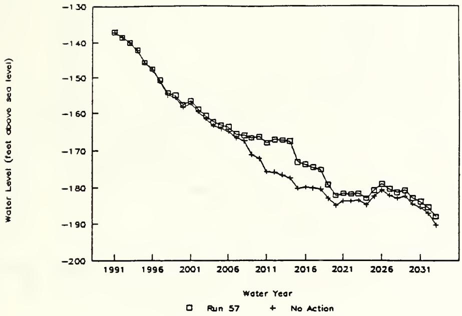

SF GOLF CLUB – USGS (LAYER 1)

Figure K-6, continued.

DALY CITY WELLS 8 – 11 (LAYER 3)



CEMETERY WELLS (LAYER 3)

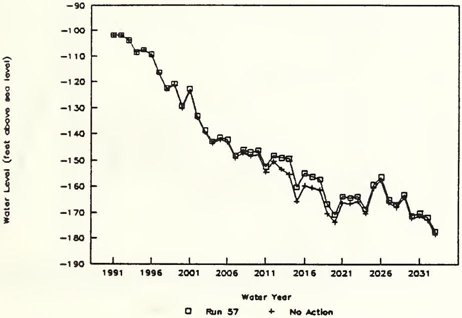
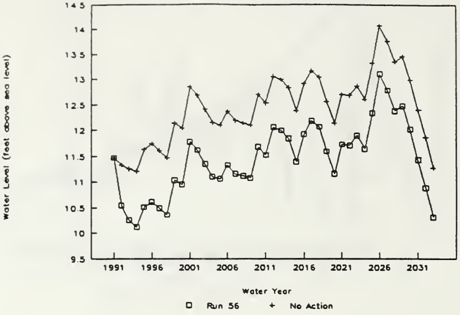


Figure K-6, continued.

SANTIAGO SOUTH (LAYER 3)



STERN GROVE (LAYER 1)

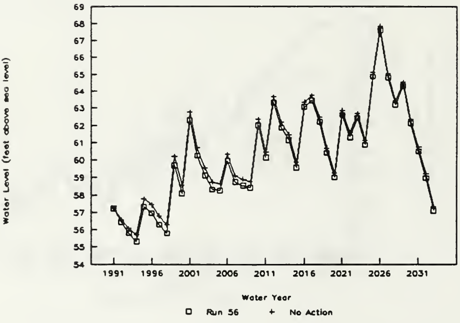
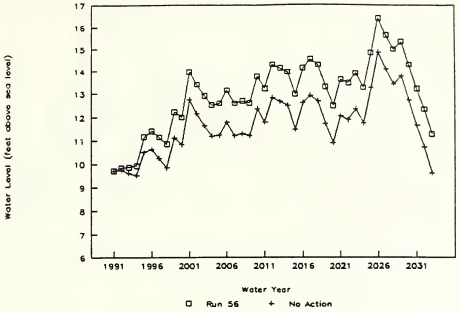


Figure K-7. Simulated water levels during 1991-2032 with 100 Mgal per year added to Lake Merced from a deep well near North Lake.

SOUTH LAKE



IMPOUND LAKE

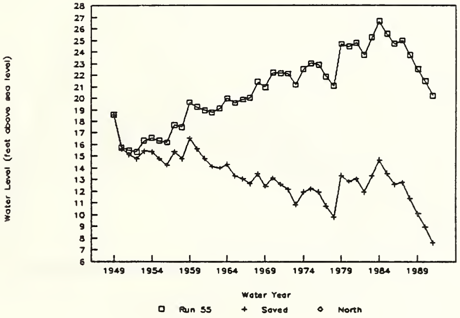
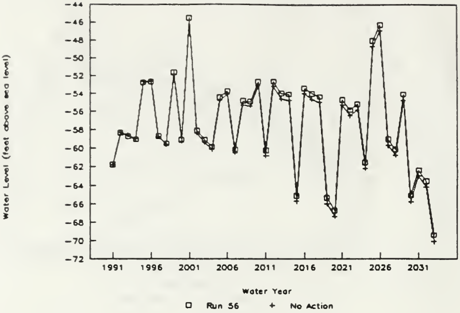


Figure K-7, continued.

SF GOLF CLUB WEST (LAYER 3)



SF GOLF CLUB – USGS (LAYER 1)

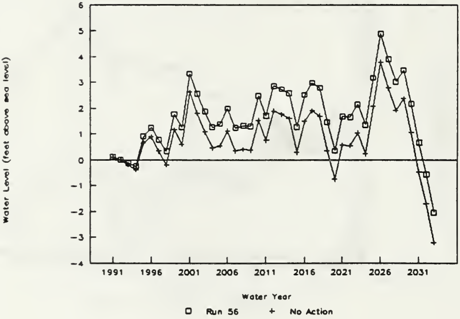
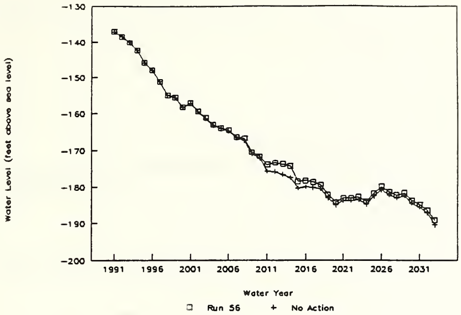
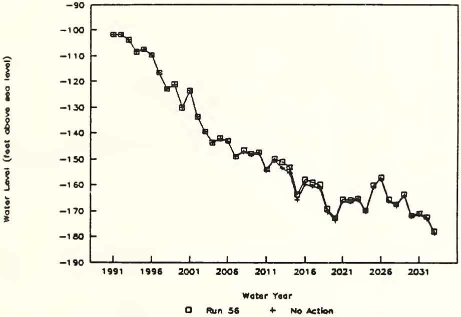


Figure K-7, continued.

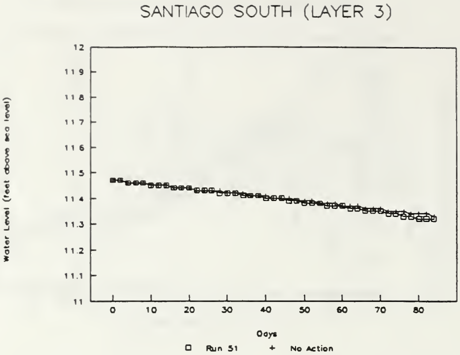


DALY CITY WELLS 8 – 11 (LAYER 3)



CEMETERY WELLS (LAYER 3)

Figure K-7, continued.



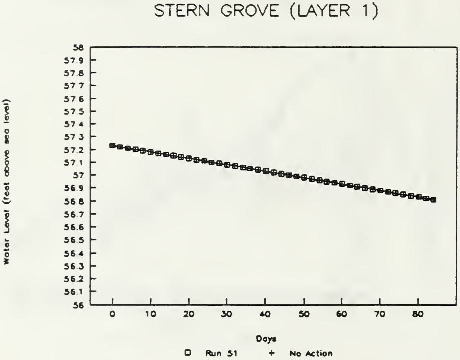
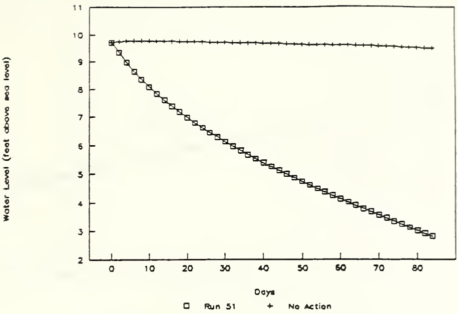


Figure K-8. Simulated water levels in fall 1990 with emergency pumping at a rate of 50 Mgd for 84 days.

SOUTH LAKE



IMPOUND LAKE

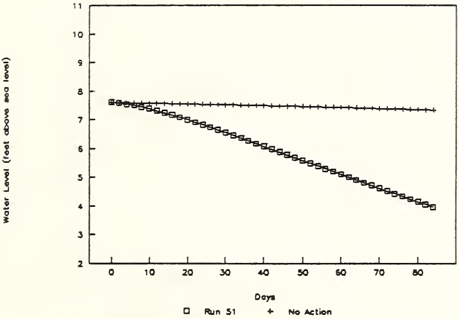
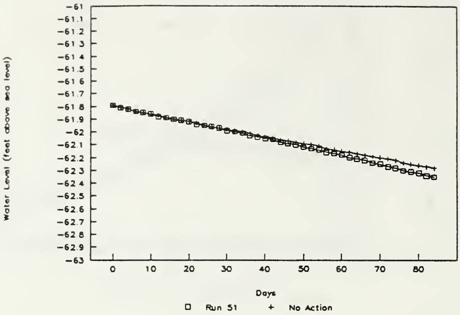


Figure K-8, continued.

SF GOLF CLUB WEST (LAYER 3)



SF GOLF CLUB – USGS (LAYER 1)

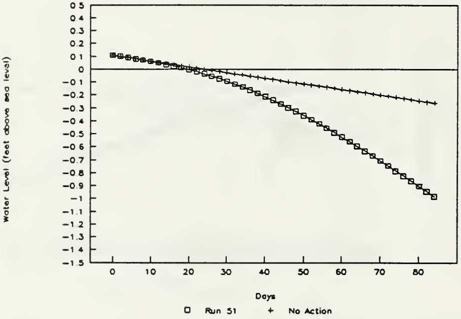
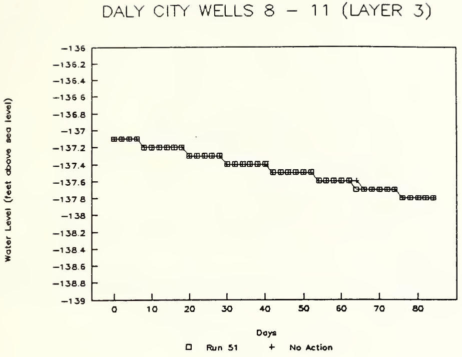


Figure K-8, continued.



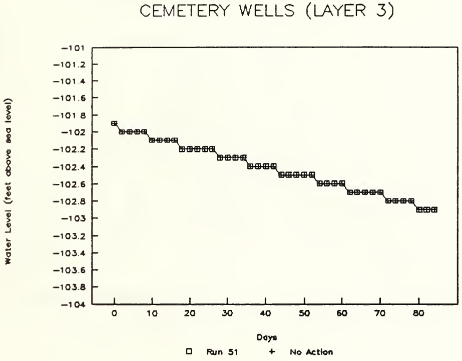
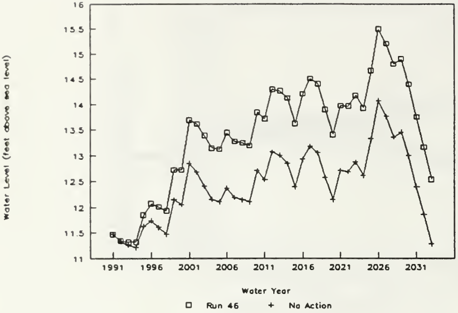


Figure K-8, continued.

SANTIAGO SOUTH (LAYER 3)



STERN GROVE (LAYER 1)

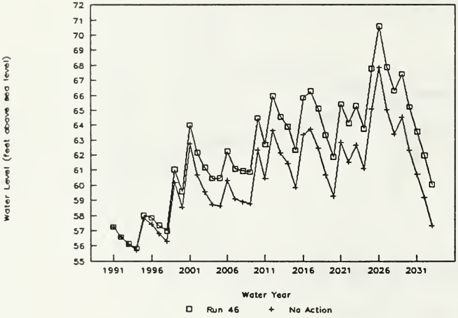


Figure K-9. Simulated water levels during 1991-2032 with diversions of stormwater runoff from Vista Grande canal to South Lake.

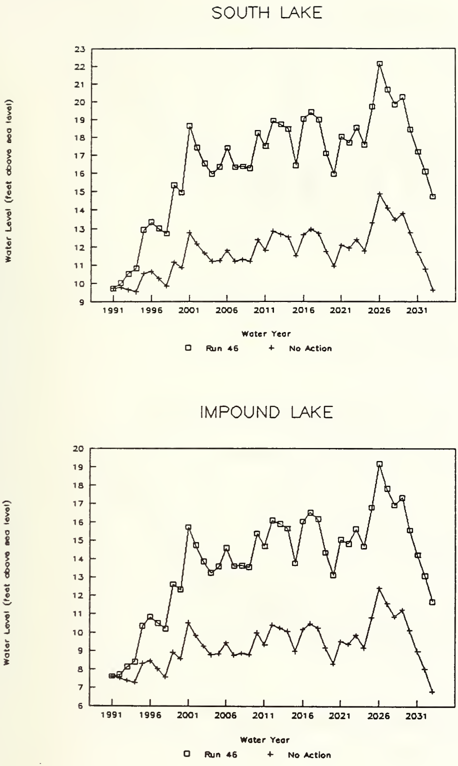
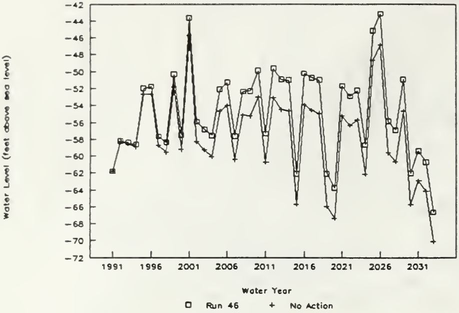
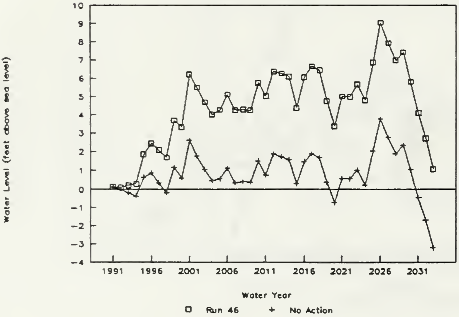


Figure K-9, continued.

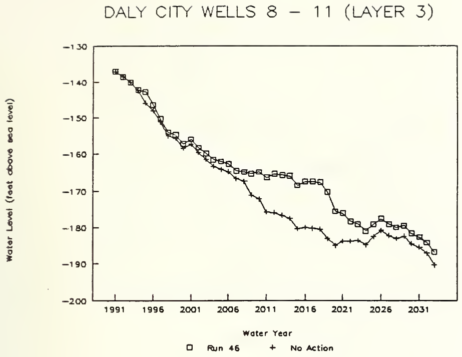


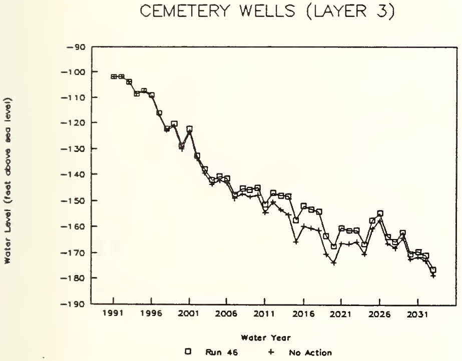
SF GOLF CLUB WEST (LAYER 3)



SF GOLF CLUB – USGS (LAYER 1)

Figure K-9, continued.





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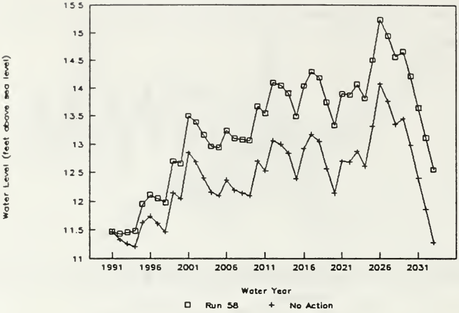

SANTIAGO SOUTH (LAYER 3)

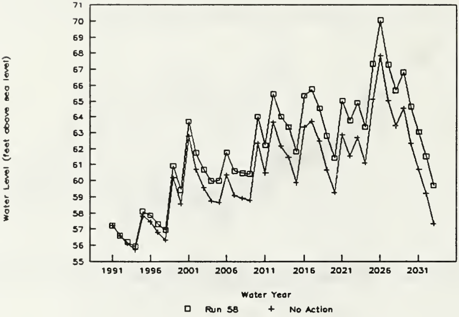

STERN GROVE (LAYER 1)

Figure K-10. Simulated water levels during 1991-2032 with municipal or reclaimed water used to irrigate golf courses.

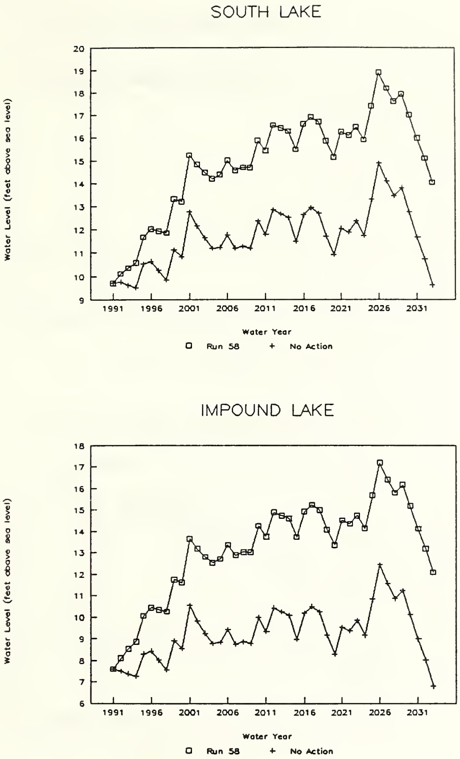
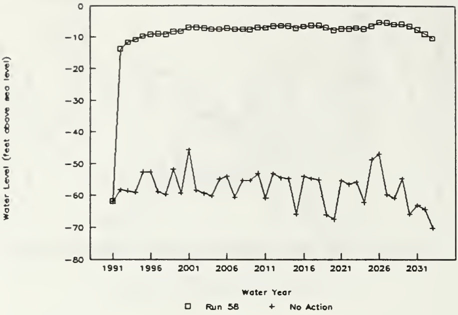
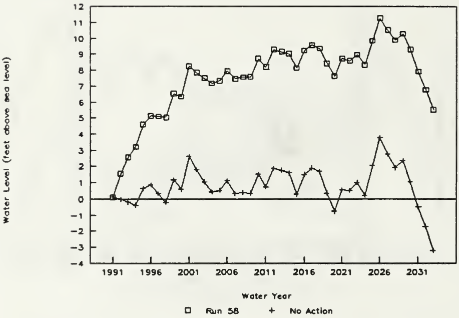


Figure K-10, continued.

SF GOLF CLUB WEST (LAYER 3)



SF GOLF CLUB – USGS (LAYER 1)



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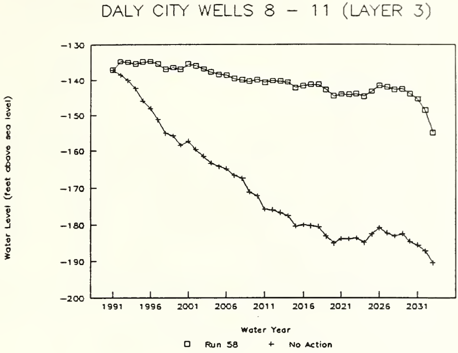


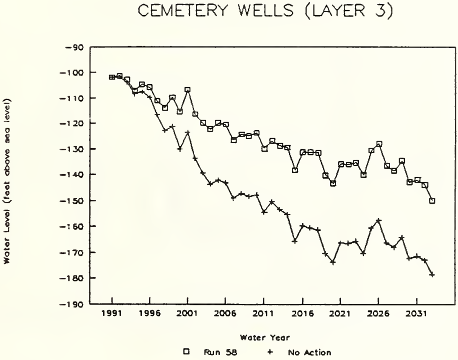
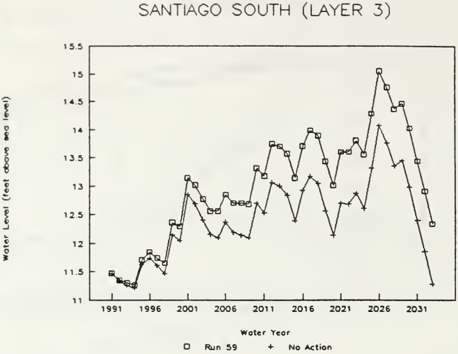


Figure K-10, continued.



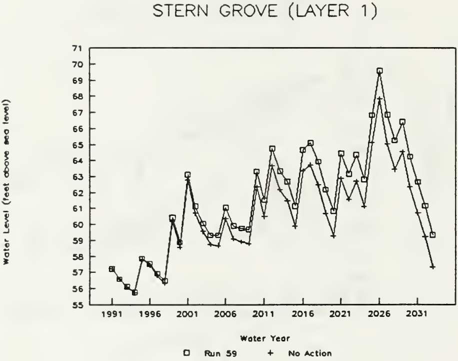
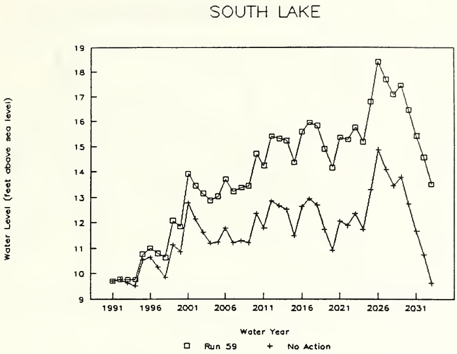


Figure K-11. Simulated water levels during 1991-2032 with Daly City municipal pumpage decreased by 1 Mgd.



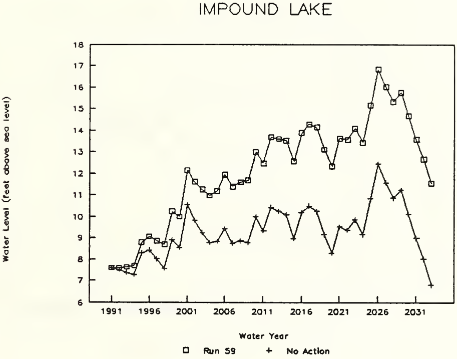
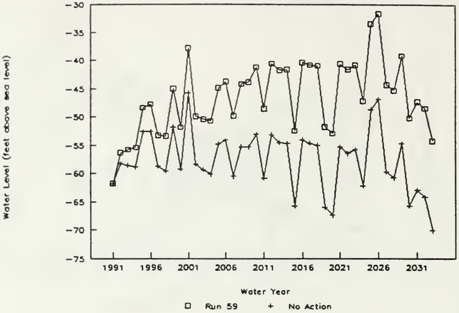


Figure K-11, continued.

SF GOLF CLUB WEST (LAYER 3)



SF GOLF CLUB – USGS (LAYER 1)

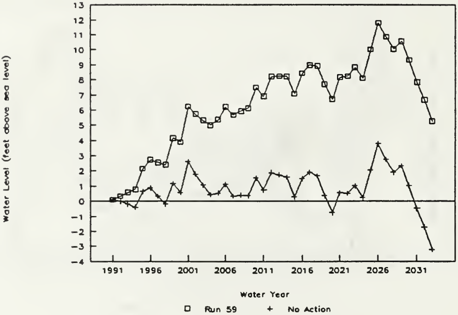
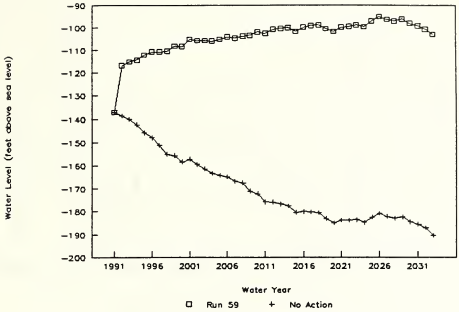


Figure K-11, continued.

DALY CITY WELLS 8 – 11 (LAYER 3)



CEMETERY WELLS (LAYER 3)

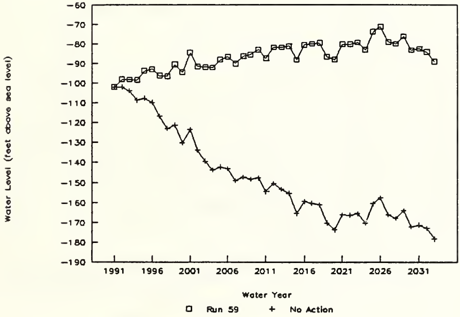
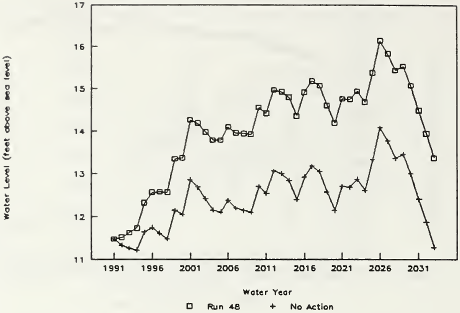


Figure K-11, continued.

SANTIAGO SOUTH (LAYER 3)



STERN GROVE (LAYER 1)

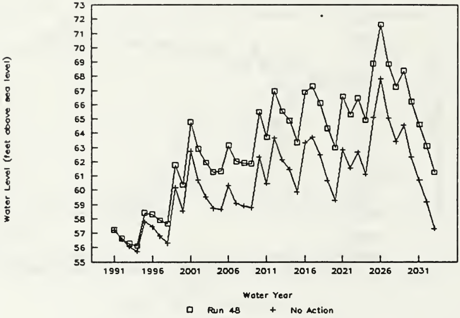
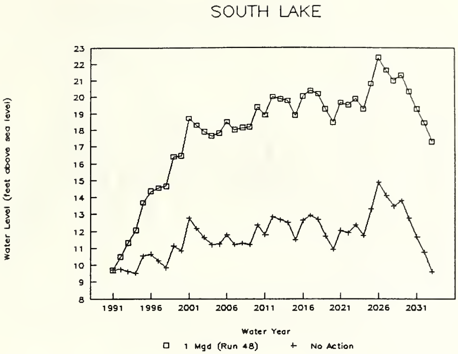
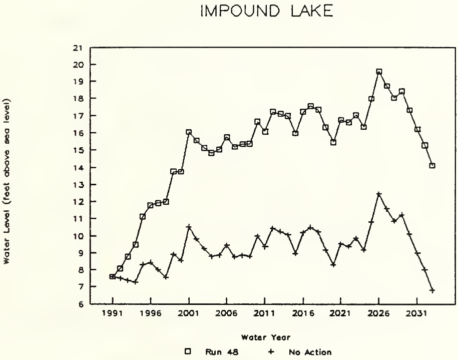


Figure K-12. Simulated water levels during 1991-2032 with 0.4 Mgd of reclaimed water recharged along the sand barrier.

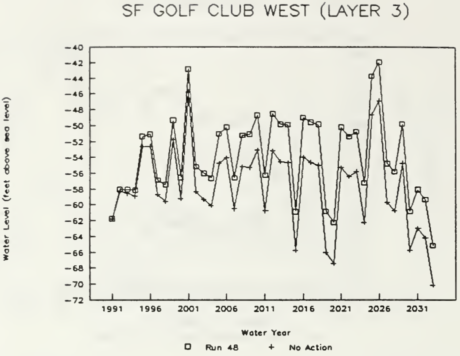


SOUTH LAKE



IMPOUND LAKE

Figure K-12, continued.



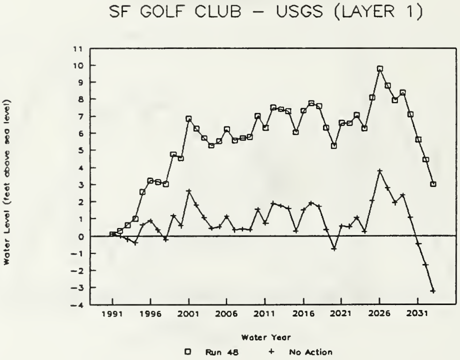
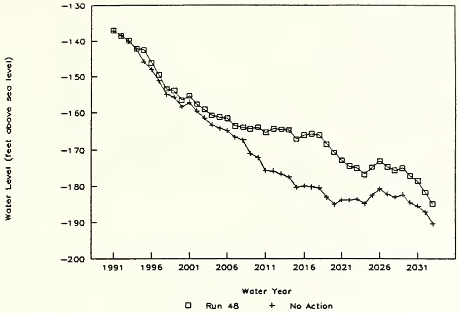


Figure K-12, continued.

DALY CITY WELLS 8 – 11 (LAYER 3)



CEMETERY WELLS (LAYER 3)

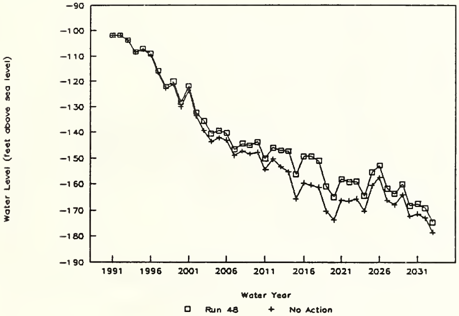
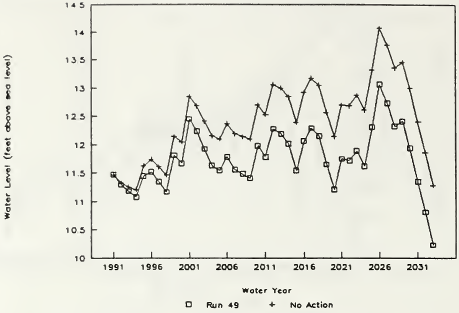


Figure K-12, continued.

SANTIAGO SOUTH (LAYER 3)



STERN GROVE (LAYER 1)

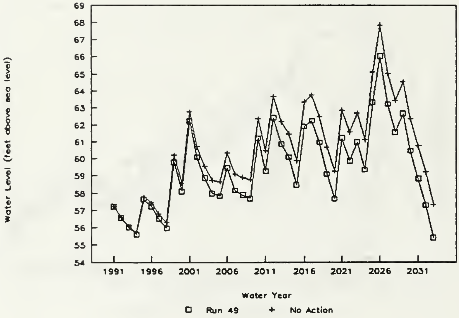
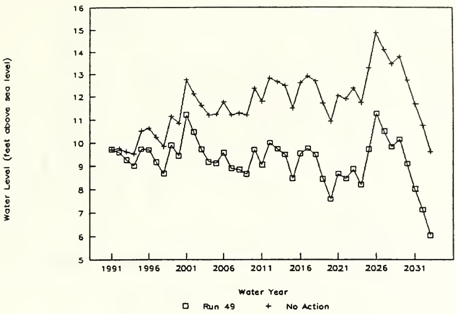


Figure K-13. Simulated water levels during 1991-2032 with two new municipal wells in Daly City pumping at a combined rate of 1 Mgd.

SOUTH LAKE



IMPOUND LAKE

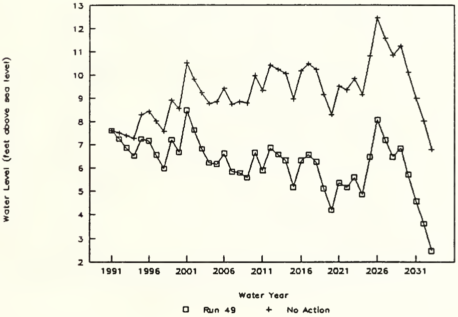


Figure K-13, continued.

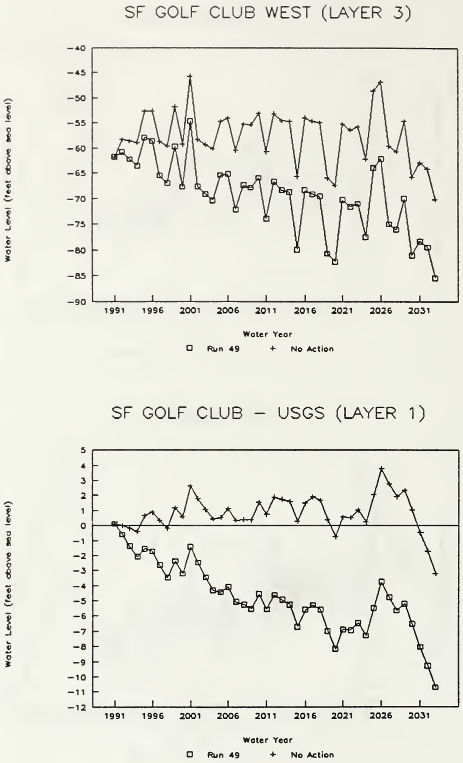
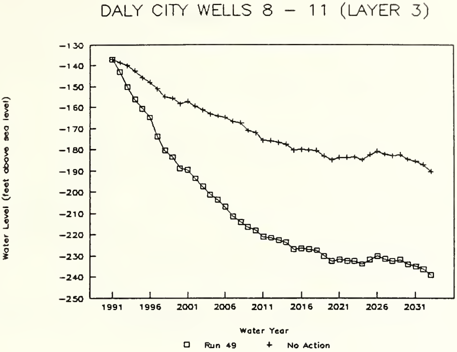


Figure K-13, continued.



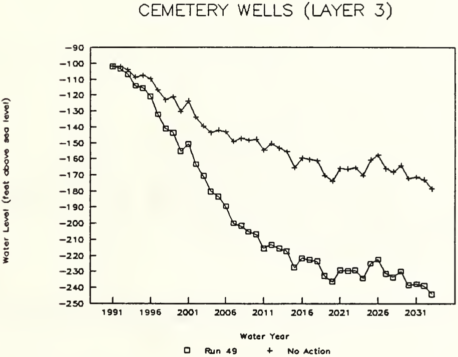
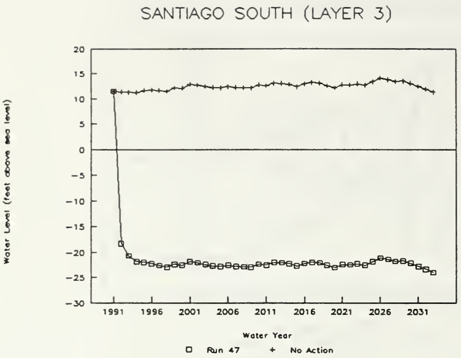


Figure K-13, continued.



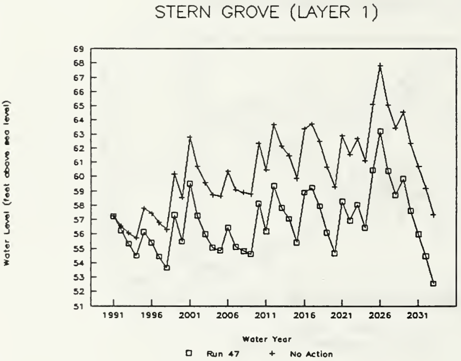
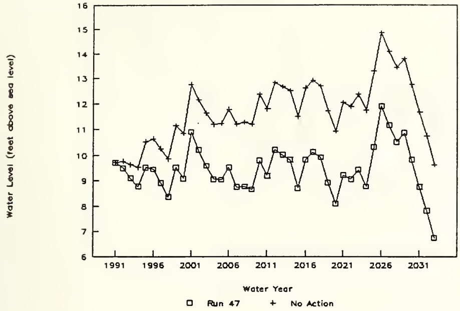


Figure K-14. Simulated water levels during 1991-2032 with a municipal well at 44th Avenue and Santiago Street pumping at a rate of 1 Mgd.

SOUTH LAKE



IMPOUND LAKE

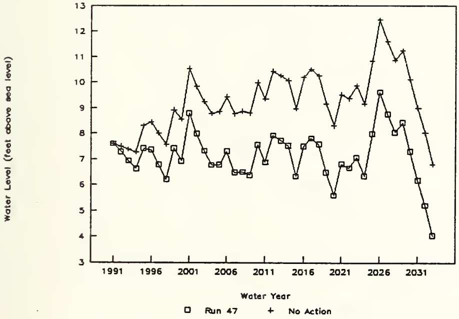
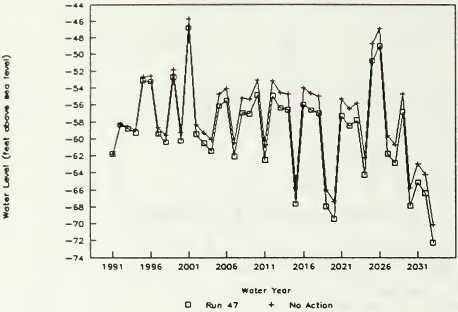


Figure K-14, continued.

SF GOLF CLUB WEST (LAYER 3)



SF GOLF CLUB – USGS (LAYER 1)

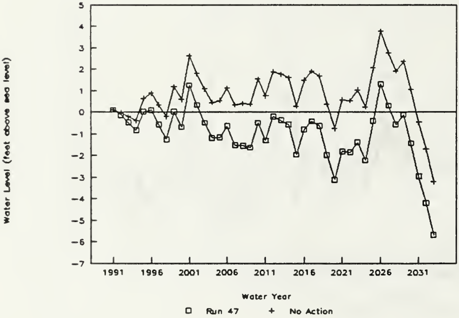
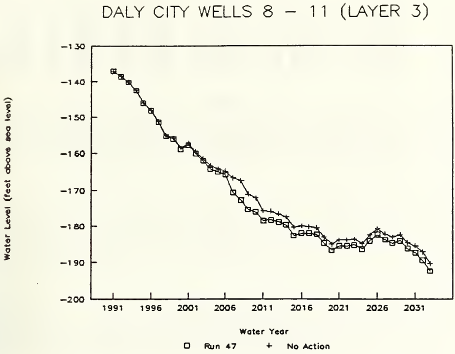
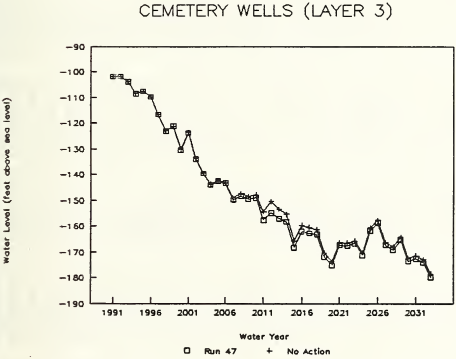


Figure K-14, continued.



DALY CITY WELLS 8 – 11 (LAYER 3)



CEMETERY WELLS (LAYER 3)

Figure K-14, continued.

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1                U.S. GEOLOGICAL SURVEY MODULAR FINITE-DIFFERENCE GROUND-WATER MODEL
Lake Merced 3-Layer Model;  Calibration Simulation; 1949-1990
   3 LAYERS       44 ROWS       39 COLUMNS
  42 STRESS PERIOD(S) IN SIMULATION
 MODEL TIME UNIT IS DAYS
 TRANSIENT SIMULATION
 HEAD AT CELLS THAT CONVERT TO DRY=  0.00000
 WETTING CAPABILITY IS NOT ACTIVE


0AQUIFER HEAD WILL BE SET TO  999.99     AT ALL NO-FLOW NODES (IBOUND=0).
0
0                HYDRAULIC CONDUCTIVITY BY ROW IN LAYER 1 (FEET PER DAY)
                 --------------------------------------------------------------
     11    1.000(10E12.4)            -1
  1.5000e+01  1.5000e+01  1.5000e+01  1.5000e+01  1.5000e+01  1.5000e+01  1.5000e+01  1.5000e+01  1.5000e+01  1.5000e+01
  1.5000e+01  1.5000e+01  1.5000e+01  1.5000e+01  1.5000e+01  1.5000e+01  1.5000e+01  1.5000e+01  1.5000e+01  1.5000e+01
  4.0000e+00  4.0000e+00  4.0000e+00  4.0000e+00  4.0000e+00  4.0000e+00  2.0000e+00  1.0000e+00  1.5000e+01  1.5000e+01
  1.5000e+01  1.5000e+01  1.5000e+01  1.5000e+01  1.5000e+01  1.5000e+01  1.5000e+01  1.5000e+01  1.5000e+01
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  1.5000e+01  4.0000e+00  4.0000e+00  4.0000e+00  4.0000e+00  4.0000e+00  4.0000e+00  4.0000e+00  2.0000e+00  2.0000e+00
  2.0000e+00  2.0000e+00  1.0000e+00  1.5000e+01  1.5000e+01  1.0000e+00  1.0000e+00  1.0000e+00  5.0000e-01
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Table K-1. Model grid dimensions, aquifer characteristics, and inflow from upgradient bedrock areas.

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0             TRANSMISSIVITY BY ROW IN LAYER 3 (FT2 PER DAY)
              ------------------------------------------------
    11    1.000(10E12.4)          -1
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1.6200e+03  1.6200e+03  1.6200e+03  9.7200e+02  9.7200e+02  9.7200e+02  9.7200e+02  9.7200e+02  3.2400e+02  3.2400e+02
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3.2400e+02  5.0000e-04  5.0000e-04  5.0000e-04  5.0000e-04  5.0000e-04  5.0000e-04  5.0000e-04  5.0000e-04
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1.6200e+03  1.6200e+03  1.6200e+03  9.7200e+02  9.7200e+02  9.7200e+02  3.2400e+02  3.2400e+02  3.2400e+02  3.2400e+02
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1.6200e+03  1.6200e+03  1.6200e+03  9.7200e+02  9.7200e+02  9.7200e+02  3.2400e+02  3.2400e+02  3.2400e+02  5.0000e-04
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1.6200e+03  1.6200e+03  1.6200e+03  9.7200e+02  9.7200e+02  9.7200e+02  3.2400e+02  3.2400e+02  3.2400e+02  5.0000e-04
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1.6200e+03  1.6200e+03  1.6200e+03  9.7200e+02  9.7200e+02  9.7200e+02  3.2400e+02  3.2400e+02  3.2400e+02  5.0000e-04
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1.6200e+03  1.6200e+03  1.6200e+03  9.7200e+02  9.7200e+02  9.7200e+02  3.2400e+02  3.2400e+02  3.2400e+02  5.0000e-04
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1.6200e+03  1.6200e+03  1.6200e+03  1.6200e+03  9.7200e+02  9.7200e+02  3.2400e+02  3.2400e+02  3.2400e+02  5.0000e-04
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0                                    BOTTOM =  -80.00000    FOR LAYER  1
0                           VERT HYD COND /THICKNESS =  0.3000000E-03 FOR LAYER  1
0                             PRIMARY STORAGE COEF =  0.5000000E-01 FOR LAYER  2
0                             TRANSMIS. ALONG ROWS =  0.5000000E-03 FOR LAYER  2
0                           VERT HYD COND /THICKNESS =  0.3000000E-03 FOR LAYER  2
0                             PRIMARY STORAGE COEF =  0.2000000E-02 FOR LAYER  3
0
                             SOLUTION BY THE STRONGLY IMPLICIT PROCEDURE
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0                          MAXIMUM ITERATIONS ALLOWED FOR CLOSURE =     200
                                    ACCELERATION PARAMETER =    0.60000
                             HEAD CHANGE CRITERION FOR CLOSURE =    0.10000E-01
                             SIP HEAD CHANGE PRINTOUT INTERVAL =      1
0                             CALCULATE ITERATION PARAMETERS FROM MODEL CALCULATED WSEED
1                            STRESS PERIOD NO.   1, LENGTH =   365.2500
                             ----------------------------------------------

                            NUMBER OF TIME STEPS =    1

                             MULTIPLIER FOR DELT =    1.000

                           INITIAL TIME STEP SIZE =   365.2500
0       77 WELLS
                          LAYER   ROW   COL   STRESS RATE   WELL NO.
                          ----------------------------------------------
                            1     44    38     1600.0         1
                            1     43    37     1000.0         2
                            1     42    36     1000.0         3
                            1     41    34     1200.0         4
                            1     40    34     4441.0         5
                            1     39    33     800.00         6
                            1     38    33     400.00         7
                            1     37    33     200.00         8
                            1     36    33     100.00         9
                            3     44    35    0.00000        10
                            3     44    33    -11896.        11
                            3     44    32    -11896.        12
                            3     43    31    0.00000        13
                            3     41    29    0.00000        14
                            3     39    31   -0.10972E+06     15
                            3     39    28    0.00000        16
                            3     40    25    0.00000        17
                            3     39    23    0.00000        18
                            3     34    22    -47545.        19
                            3     34    28    -34589.        20
                            3      5    29   -4532.0        21
                            3      5     9   -2283.0        22
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1   5   9   -1141.0     23
3  18  23    -31962.     24
1  37  39    400.00     25
1  37  38    400.00     26
1  37  37    400.00     27
1  38  36    200.00     28
1  37  35    168.00     29
1  30  36    800.00     30
1  29  35    700.00     31
1  29  34    600.00     32
1  29  33    600.00     33
1  27  32    400.00     34
1  25  32    400.00     35
1  25  33    600.00     36
1  24  34    600.00     37
1  26  35    700.00     38
1  26  36    700.00     39
1  25  37    800.00     40
1  11  38    200.00     41
1  10  37    200.00     42
1   9  36   400.00     43
1  10  36    400.00     44
1  11  36    400.00     45
1  12  36    400.00     46
1  13  36    400.00     47
1  14  36    400.00     48
1  15  36    400.00     49
1  16  36    400.00     50
1  17  36    400.00     51
1  18  34    700.00     52
1  18  35    700.00     53
1  18  33    600.00     54
1  15  33    600.00     55
1  13  34    700.00     56
1  10  34    400.00     57
1  11  34    400.00     58
1  12  34    400.00     59
1   9  34   500.00     60
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 1    8   34   600.00     61
 1    7   34   700.00     62
 1    6   35   800.00     63
 1    5   35   1200.0     64
 1    4   35   1200.0     65
 1    3   36   1000.0     66
 1    3   37   1000.0     67
 1    3   38   1000.0     68
 1    3   39   1000.0     69
 1    2   39   3600.0     70
 1    2   36   3000.0     71
 1    2   37   3000.0     72
 1    2   38   3000.0     73
 1    3   34   700.00     74
 1    3   35   700.00     75
 1    2   33   950.00     76
 1   26    23  0.00000      77
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Table K-2. Seasonal Distribution of Recharge and Pumpage Used in the Groundwater Model.

Land Use Type	Percentage of Annual Total Occurring in Each Season			
	Recharge		Pumpage	
	Winter	Summer	Winter	Summer
Golf Courses, Cemeteries, Parks	60	40	25	75
Residential and Commercial	75	25	45	55
Undeveloped	100	0	N.A.	N.A.

Table K-3. Average Annual Pumpage and Groundwater Recharge for Land Use Zones Under Present Level of Development (1971–1990 Average).

Land Use Zone	Area (acres)	Irrigation Pumpage (af/yr)	Groundwater Recharge (af/yr)
Within Groundwater Basin			
Fleishhacker Zoo	94	27	93
Stern Grove	78	36	88
Harding Park Golf Course	146	251	123
San Francisco Golf Club	158	272	121
Olympic Golf Club	253	374	194
Lake Merced Country Club	120	207	92
Cemeteries (north half only)	250	431	192
Residential & Commercial	6,594	0	4,007
Undeveloped	738	0	366
Lake Merced (plus tules)	311	0	–173
TOTAL	8,742	1,598	5,103
Tributary to Groundwater Basin			
Bedrock Uplands	1,446	0	426

Table K-4. Annual Pumpage at Wells in the Modeled Area During Water Years 1949–1990, in Acre-Feet.

WELL:	Cemetery Wells		Daly City Municipal Wells					Golf Course Wells					Stern Grove	Zoo #3 and #4	
			1–2	3	4	8–11	12	Lake Merced C.C.	Olympic G.C.	San Francisco G.C.	Harding Park G. C.			Deep	Shallow
											Well	Lake			
LAYER:	3	3	3	3	3	3	3	3	3	3	3	1	3	3	1
ROW:	44	44	39	40	41	39	43	39	34	34	18	26	5	5	5
COLUMN:	33	32	23	25	29	31	31	28	22	28	23	23	29	9	9
1949	100	100	0	0	0	920	0	0	399	290	268	0	38	19	10
1950	122	122	0	0	0	1,062	0	0	399	290	268	0	38	19	10
1951	144	144	0	0	0	1,203	0	0	399	290	268	0	38	19	10
1952	143	143	0	0	0	1,345	0	0	345	250	231	0	32	17	8
1953	164	164	0	0	0	1,486	0	0	347	252	233	0	30	15	8
1954	210	210	0	0	0	1,628	0	0	399	290	268	0	38	19	10
1955	232	232	126	0	0	1,677	0	0	399	290	268	0	38	19	10
1956	212	212	277	0	0	1,769	0	0	332	241	223	0	34	17	9
1957	277	277	428	0	0	1,769	0	0	399	290	268	0	38	19	10
1958	212	212	579	0	0	1,769	0	0	284	206	190	0	28	15	7
1959	321	321	729	0	0	1,769	101	0	399	290	268	0	38	19	10
1960	343	343	880	0	0	1,769	235	0	399	290	268	0	38	19	10
1961	365	365	1,031	0	0	1,769	369	0	399	290	268	0	38	19	10
1962	337	337	1,182	84	0	1,769	503	0	347	252	233	0	30	15	8
1963	353	353	1,333	168	0	1,769	637	0	345	250	231	0	32	17	8
1964	431	431	1,484	252	0	1,769	637	210	399	290	268	0	38	19	10
1965	394	394	1,635	252	0	1,769	637	192	347	252	233	0	30	15	8
1966	394	394	1,786	252	0	1,769	637	192	347	252	233	0	30	15	8
1967	377	377	1,937	252	0	1,769	637	183	332	241	223	0	34	17	9
1968	453	453	2,088	252	0	1,769	637	220	399	290	268	0	38	19	10
1969	377	377	2,239	252	0	1,769	637	183	332	241	223	0	34	17	9
1970	394	394	2,239	252	0	1,769	637	192	347	252	233	0	30	15	8
1971	394	394	2,239	252	0	1,744	587	192	347	252	233	0	30	15	8
1972	499	499	1,719	252	0	1,719	587	242	439	319	295	0	42	21	11
1973	377	377	1,635	252	0	1,694	587	183	332	241	223	0	34	17	9
1974	391	391	1,551	252	0	1,669	587	190	345	250	231	0	32	17	8
1975	394	394	1,534	252	0	1,643	587	192	347	252	233	0	30	15	8
1976	499	499	1,518	252	0	1,618	587	242	439	319	295	0	42	21	11
1977	499	499	1,501	252	0	1,593	587	242	439	319	295	0	42	21	11
1978	377	377	1,484	252	0	1,568	587	183	332	241	223	0	34	17	9
1979	394	394	1,467	252	0	1,543	587	192	347	252	233	0	30	15	8
1980	391	391	1,451	252	0	1,425	587	190	345	250	231	0	32	17	8
1981	453	453	1,434	252	201	1,425	587	220	399	290	0	268	38	19	10
1982	321	321	1,434	252	402	1,425	587	156	284	206	0	190	28	15	7
1983	321	321	1,233	252	604	1,425	587	156	284	206	0	190	28	15	7
1984	453	453	1,233	252	805	1,425	587	220	399	290	0	268	38	19	10
1985	453	453	1,233	252	922	1,425	587	220	399	290	0	268	38	19	10
1986	391	391	1,233	252	922	1,425	587	190	345	250	0	231	32	17	8
1987	499	499	1,233	252	922	1,425	587	242	439	319	0	295	42	21	11
1988	453	453	1,233	252	922	1,425	587	220	399	290	0	268	38	19	10
1989	453	453	1,233	252	922	1,425	587	220	399	290	0	268	38	19	10
1990	499	499	1,233	252	922	1,425	587	242	439	319	0	295	42	21	11
Average (1971–90)	426	426	1,441	252	377	1,524	587	207	375	272	125	66	36	18	9

Table K-4. Annual Pumpage at Wells in the Modeled Area During Water Years 1949–1990, in Acre–Feet.

								Golf Course Wells							
WELL:	Cemetery Wells		Daly City Municipal Wells					Lake Merced C.C.	Olympic G.C.	San Francisco G.C.	Harding Park G. C.		Stern Grove	Zoo #3 and #4	
			1–2	3	4	8–11	12				Well	Lake		Deep	Shallow
LAYER:	3	3	3	3	3	3	3	3	3	3	3	1	3	3	1
ROW:	44	44	39	40	41	39	43	39	34	34	18	26	5	5	5
COLUMN:	33	32	23	25	29	31	31	28	22	28	23	23	29	9	9
1949	100	100	0	0	0	920	0	0	399	290	268	0	38	19	10
1950	122	122	0	0	0	1,062	0	0	399	290	268	0	38	19	10
1951	144	144	0	0	0	1,203	0	0	399	290	268	0	38	19	10
1952	143	143	0	0	0	1,345	0	0	345	250	231	0	32	17	8
1953	164	164	0	0	0	1,486	0	0	347	252	233	0	30	15	8
1954	210	210	0	0	0	1,628	0	0	399	290	268	0	38	19	10
1955	232	232	126	0	0	1,677	0	0	399	290	268	0	38	19	10
1956	212	212	277	0	0	1,769	0	0	332	241	223	0	34	17	9
1957	277	277	428	0	0	1,769	0	0	399	290	268	0	38	19	10
1958	212	212	579	0	0	1,769	0	0	284	206	190	0	28	15	7
1959	321	321	729	0	0	1,769	101	0	399	290	268	0	38	19	10
1960	343	343	880	0	0	1,769	235	0	399	290	268	0	38	19	10
1961	365	365	1,031	0	0	1,769	369	0	399	290	268	0	38	19	10
1962	337	337	1,182	84	0	1,769	503	0	347	252	233	0	30	15	8
1963	353	353	1,333	168	0	1,769	637	0	345	250	231	0	32	17	8
1964	431	431	1,484	252	0	1,769	637	210	399	290	268	0	38	19	10
1965	394	394	1,635	252	0	1,769	637	192	347	252	233	0	30	15	8
1966	394	394	1,786	252	0	1,769	637	192	347	252	233	0	30	15	8
1967	377	377	1,937	252	0	1,769	637	183	332	241	223	0	34	17	9
1968	453	453	2,088	252	0	1,769	637	220	399	290	268	0	38	19	10
1969	377	377	2,239	252	0	1,769	637	183	332	241	223	0	34	17	9
1970	394	394	2,239	252	0	1,769	637	192	347	252	233	0	30	15	8
1971	394	394	2,239	252	0	1,744	587	192	347	252	233	0	30	15	8
1972	499	499	1,719	252	0	1,719	587	242	439	319	295	0	42	21	11
1973	377	377	1,635	252	0	1,694	587	183	332	241	223	0	34	17	9
1974	391	391	1,551	252	0	1,669	587	190	345	250	231	0	32	17	8
1975	394	394	1,534	252	0	1,643	587	192	347	252	233	0	30	15	8
1976	499	499	1,518	252	0	1,618	587	242	439	319	295	0	42	21	11
1977	499	499	1,501	252	0	1,593	587	242	439	319	295	0	42	21	11
1978	377	377	1,484	252	0	1,568	587	183	332	241	223	0	34	17	9
1979	394	394	1,467	252	0	1,543	587	192	347	252	233	0	30	15	8
1980	391	391	1,451	252	0	1,425	587	190	345	250	231	0	32	17	8
1981	453	453	1,434	252	201	1,425	587	220	399	290	0	268	38	19	10
1982	321	321	1,434	252	402	1,425	587	156	284	206	0	190	28	15	7
1983	321	321	1,233	252	604	1,425	587	156	284	206	0	190	28	15	7
1984	453	453	1,233	252	805	1,425	587	220	399	290	0	268	38	19	10
1985	453	453	1,233	252	922	1,425	587	220	399	290	0	268	38	19	10
1986	391	391	1,233	252	922	1,425	587	190	345	250	0	231	32	17	8
1987	499	499	1,233	252	922	1,425	587	242	439	319	0	295	42	21	11
1988	453	453	1,233	252	922	1,425	587	220	399	290	0	268	38	19	10
1989	453	453	1,233	252	922	1,425	587	220	399	290	0	268	38	19	10
1990	499	499	1,233	252	922	1,425	587	242	439	319	0	295	42	21	11
Average (1971–90)	426	426	1,441	252	377	1,524	587	207	375	272	125	127	36	18	9

Revised 12-3-92

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